

Chapter 2

The Impact of Education Policies on Socioeconomic Inequality in Student Achievement: A Review of Comparative Studies



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Abstract This chapter reviews international comparative studies on the determinants of socioeconomic inequality in student performance. We were interested in studies of explanatory variables that are amenable to educational policy interventions. To identify such publications, we developed a comprehensive search strategy and conducted an electronic search based on six databases. We also manually searched two existing hand-picked reviews. After duplicates were removed, the search resulted in 814 references, of which a total of 35 studies met the eligibility criteria. The included studies investigated diverse topics such as learning environments inside and outside of school, educational expenditure, teacher education, autonomy, accountability, differentiation, and competition from private schools. Most studies are descriptive in nature and their findings are sometimes ambiguous. Despite these limitations, we tentatively conclude that the opportunity of choice reinforces inequality. Measures that target social selection can be effective.

Keywords Student achievement · Socioeconomic status · Inequality · Comparative analysis

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2.1 Introduction

In virtually all countries, the socioeconomic status (SES) of students is correlated with their performance in standardized achievement tests. International large-scale assessments have become established as a unique resource to study such inequalities because they provide internationally comparable indicators to compare the degree of SES inequality in different countries. Even though it is inherently difficult to find internationally comparable measures of SES and achievement (see Chap. 1), there are at least three methodological advantages of such a comparative approach. First, many institutional features do not vary within a single country (e.g., the existence of national examinations) and as such, comparative studies are the only approach to observe variation in these features. Furthermore, even if determinants of inequality vary within a single country, the variations in the pooled international data from several countries are frequently much larger than those within a single country (Hanushek & Woessmann, 2011). Second, it is possible to replicate analyses to test the generalizability of research findings in different countries. Third, while within-country SES inequality may be in part due to genetics, cross-national inequalities are more likely to be due to differences in the learning environments. We restrict the present review to comparative studies that employ data from at least two countries. In addition to this cross-national perspective, the following chapters will complement the comparative perspective with in-depth descriptions of the situations in different countries.

Several studies have investigated determinants of academic success for all students, regardless of student SES, but few studies have focused on SES inequality as the issue of interest. Such studies on effect heterogeneity are precisely the research we are interested in. Common approaches to test for effect heterogeneity are (a) interaction effects between the main explanatory variable and SES, (b) two-step approaches where the computation of an SES inequality measure and modeling variation in this measure are two separate steps, and (c) replicating analyses for different SES groups. It seems also worth mentioning that studies focusing exclusively on the academic success of low SES students are outside the scope of this review because by design such studies permit no inferences about effect heterogeneity. Furthermore, we excluded studies that investigate whether the effect of SES on achievement changes after controlling for some other explanatory variables: changes in effects can be due to an association between the explanatory variable and SES (suggesting inequality in the access to educational opportunity), but they do not directly generate information about effect heterogeneity.

Our objective is to review the international comparative evidence on the determinants of SES inequality in achievement. We are interested in studies of explanatory variables that are amendable by educational policy interventions, but not in factors such as gender, geographical space (e.g., urban, rural), or economic development. Further, we do not consider motivational variables (e.g., interest, emotion) as determinants of SES achievement inequality because we think that they are essentially alternative educational outcomes. Therefore, SES inequality in motivational variables

is beyond the scope of this review. Studies that do not report the effect of single determinants of SES inequality but only the overall effect of several determinants will not be included (e.g., Heyneman & Loxley, 1983, and studies that replicated this study). To evaluate the quality of the existing body of evidence, we review the source studies and how SES inequality was measured in previous research.

2.2 Methods

2.2.1 Selection Criteria

We include studies that meet the following five criteria to synthesize the existing evidence determinants of socioeconomic inequality:

- (1) Apply an indicator of SES inequality based on measures of SES and achievement.
- (2) Apply a measure of a determinant of SES inequality.
- (3) Report quantitative data on the relationship between (1) and (2) in sufficient detail.
- (4) Include in its sample primary or secondary school students from two or more countries.
- (5) Be published in a professional journal in English.

2.2.2 Keywords and Data Collection

The electronic search was conducted using *EconLit*, *ERIC*, *PsychINFO*, *Scopus*, *SocINDEX*, and *Web of Science*. We combined three sets of search terms for SES, achievement, and international study to search for references.¹ The search was limited

¹The following search function for *Web of Science*: *TS* = (“socioeconomic status” OR “socio-economic status” OR “social class” OR “social status” OR “income or disadvantaged or poverty” OR “socioeconomic background” OR “socio-economic background” OR “social background” OR “social inequality” OR “socioeconomic inequality” OR “socio-economic inequality”) AND *TS* = (achievement OR literacy OR performance) AND *TS* = (“international studies” OR “comparative analysis” OR “comparative education” OR “international assessment” OR *cived* OR *fims* OR *firs* OR *fiss* OR *iccs* OR *icils* OR *pirls* OR *pisa* OR *sims* OR *sirs* OR *siss* OR *timss* OR “civic education study” OR “first international mathematics study” OR “first international reading study” OR “first international science study” OR “international civic and citizenship education study” OR “international computer and information literacy study” OR “pilot twelve-country study” OR “programme for international student assessment” OR “progress in international reading literacy study” OR “reading literacy study” OR “second international mathematics study” OR “second international reading study” OR “second international science study” OR “six subject survey” OR “third international mathematics and science study”

to journal articles published in English. After the removal of duplicates, the search resulted in 814 references. A second targeted search was conducted in two hand-picked reviews that are related to the topic of this paper resulting in six further publications (Hanushek & Woessmann, 2011; Van de Werfhorst & Mijs, 2010). In a final step, papers that were known by the authors were added. We conducted an initial screening of the title and abstract for all references and a full-text screening of the relevant references that passed the initial screening. A total of 35 studies met all eligibility criteria and their findings will be summarized in the next section. Most studies have focused on only one topic of investigation ($n = 24$) but a subset of studies has investigated two to five determinants ($n = 11$) of SES inequality. We used all available information on different topics of investigation in the present review.

2.3 Results

2.3.1 Source Studies

Several international large-scale assessments have been conducted since the late 1960s, but data from only a few of them have been used in the publications included in this review (for more information on this research see, e.g., Meyer, Strietholt, & Epstein, 2018; Strietholt, Gustafsson, Rosén, & Bos, 2014). Most studies in this review employed data from the Programme for International Student Assessment (PISA, $n = 19$), followed by the Trends in International Mathematics and Science Study (TIMSS, $n = 9$), the Progress in International Reading Literacy Study (PIRLS, $n = 6$), the Second International Mathematics Study (SIMS, $n = 2$), and the International Civic and Citizenship Education Study (ICCS, $n = 1$). Several references combined data from different cycles of the same study ($n = 5$) or different studies ($n = 3$). PIRLS tests primary school students, while PISA, SIMS, and ICCS focus on secondary school, and TIMSS includes both primary and secondary school samples. Most included references are concerned with SES inequality in secondary schools ($n = 29$), a few aimed to explain inequality at the end of primary school ($n = 5$), and only one study aimed to explain inequalities in primary as well as secondary school ($n = 1$). The observation that most studies are based on data from PISA, TIMSS, PIRLS, and SIMS implies that most comparative research is on SES inequality in mathematics, reading, and science performance.

The scope of the studies varies from three to 65 countries. In eight, data from less than 10 countries were used, in another eight, data from 10 to 25 countries, and 19 studies used data from more than 25 countries. Some of the studies limited their

OR “trends international mathematics and science study” OR “written composition study”) along with the limiters LANGUAGE: (English) and DOCUMENT TYPES: (Article). The search function and limiters were adapted to be used for the other databases. EBSCOhost were used to search EconLit, ERIC, PsychINFO, and SocINDEX. The electronic search was conducted on February 2, 2018.

analytical samples to a homogeneous set of countries like European, East Asian, or Organisation for Economic Co-operation and Development (OECD) members. One-quarter of the studies replicated analyses for different countries and three-quarters exploited variation in the pooled data. Two studies were published prior to 2001, eight studies between 2001 and 2010, and 29 studies from 2011 onwards.

2.3.2 Measures of Socioeconomic Inequality

In studies of children and adolescents, SES has long been conceptualized as a tripartite construct, incorporating measures of parental education, parental occupation, and parental income (Duncan, Featherman, & Duncan, 1972; Gottfried, 1985; Hauser, 1994; Mueller & Parcel, 1981; White, 1982). Further to these three traditional indicators, Sirin (2005) provides grounds for the inclusion of a fourth measure of socioeconomic status, home possessions.

The studies included in this review utilized a variety of items across three of the four domains of SES (parental income is frequently excluded due to the difficulty collecting data on this item) drawn from student, parental, and school questionnaires in their measures of SES, the creation of index variables approximating SES being a common data-handling technique. There are three broad trends in the measures of SES commonly seen in the analysis of international assessment data: the use of pre-calculated indices of SES, particularly the PISA index of economic, social, and cultural status (ESCS), which appears in 10 of the 35 studies included in this analysis; the use of one or more individual survey items, for example, the number of books in the home (23% of studies) or parental education (one-third of studies); or the computation of study-specific indices of SES (Bodovski, Byun, Chykina, & Chung, 2017; Caro and Lenkeit 2012; Chiu, 2015; Witschge & van de Werfhorst, 2015) or educational capital (Chudgar, Luschei, & Zhou, 2013; Luschei & Chudgar, 2011). SES measures are most commonly deployed in regression, however a notable subset of studies utilized SES as a grouping or stratification variable for replicating models across different groups (e.g., Akiba, LeTendre, & Scribner, 2007; Chiu, 2015; Falck, Mang, & Woessmann, 2018; Lavrijsen & Nicaise, 2015; Lavy, 2015).

2.4 Determinants of Socioeconomic Inequality in Student Achievement

2.4.1 Learning Environments Outside School

Children acquire skills and competences not only in school but also in their families and in preschool. A possible explanation for why the effect of parent-child communication may vary by socioeconomic background is that low SES parents arguably have more limited resources and skills to promote children's academic

achievement. For this reason, parental involvement specifically may not have the same benefits for students from different SES families. With respect to preschool, children who grow up in less intellectually stimulating home environments may benefit more from spending time in preschool than privileged children who grow up in intellectually stimulating environments. The existing comparative research by and large supports the idea that learning environments before and outside compulsory schooling may reduce educational inequality if certain conditions are met.

2.4.2 *Home Learning Environments*

Park (2008) conducted separate regression analyses to investigate the interaction effect between SES and parent–child communication (discussing books, films, or school, and just talking) on achievement in 14 countries using PISA 2000 data. Some effects were positive, others negative, and most are nonsignificant. A striking result, however, is that the interaction effects were negative in all countries with a standardized school system (e.g., national curricula, textbooks, and exams) but positive in nonstandardized systems. Keeping the lack of statistical significance in mind, this finding suggests that efforts to increase parent–child communication could decrease the SES achievement gap because the payoff is greater for lower SES students in countries with standardized school systems. Park argues that low SES parents have greater access to the necessary knowledge about schooling in more standardized systems. In contrast, in countries with no such national standards, efforts to increase parent–child communication may actually widen the SES gap. Caro and Lenkeit (2012) replicated analyses of the interaction effect between parent–child communication and SES on achievement. They used PIRLS 2006 data, featuring a primary school sample, from five economically diverse countries and the main explanatory variable was the frequency with which parents talked to children about things they have done. Again, the interactions were small and nonsignificant.

To study the effect of shared book reading before the start of compulsory schooling on reading achievement end of primary school Araújo and Costa (2015) used PIRLS 2011 data from 22 European countries. Parents were asked how often someone in the household read to their children before the beginning of compulsory education on a three-point scale (“often”, “sometimes”, “never or almost never”). Separate comparisons were made for children from low and highly educated parents. They show that early book reading was positively associated with higher achievement in both groups, but the associations were stronger for disadvantaged children in most countries. This finding suggests that increasing book reading to young children may prevent later SES inequality. It is important to note, however, that today most parents read books to their children. The only exceptions were Bulgaria, Romania, and Wallonia (a region within Belgium) where 25–50% of the low-educated parents did *not* “often” read to their children.

Preschool children who grow up in less intellectually stimulating home environments may benefit more from spending time in preschool than privileged

children who grow up in intellectually stimulating environments. To test this hypothesis, Cebolla-Boado, Radl, and Salazar (2016) employed the pooled PIRLS 2011 data from 28 developed countries. They regressed achievement on the time children spend in preschool, SES, and their interaction. The results reveal a positive main effect but a negative interaction effect. This finding suggests that preschool benefits are lower for children from more highly educated parents, and as such preschool reduces social inequality in educational achievement.

While participation in preschool is not compulsory in most countries, family background characteristics and preschool participation correlate (Hogrebe & Strietholt, 2016). For this reason, Schütz, Ursprung, and Woessmann (2008) hypothesized that the equalizing effect of preschool does not come into effect unless a large share of children are enrolled in preschool. To test this, they analyzed the pooled grade 8 TIMSS data from 57 countries. The results suggest an inverted U-shaped relationship between the preschool enrollment rate and the SES achievement gap. The authors argued that as long as few pupils attend preschools, these are probably students from privileged backgrounds; only when a substantial share of students are enrolled does the preschool system reach disadvantaged students and have an equalizing effect. Furthermore, preschool duration was negatively related to the achievement gap, which supports the idea that particularly disadvantaged children benefit from stimulating preschool environments. Schlicht, Stadelmann-Steffen, and Freitag (2010) provide further evidence for the idea that large preschool enrollment rates are associated with lower SES gaps. They find that the effect of parental education on student achievement is smaller in countries where more than 75% of the children in the relevant age group were enrolled in preschool, using PISA data from 25 European countries. In contrast, Burger (2016) did not find a significant association between the percentage of pupils who had attended pre-primary education (ISCED 0) and the SES gap within countries using a sample of 31 European countries that participated in PISA 2012. Burger, however, did not model a nonlinear relationship between preschool enrollment rates and SES inequality and his results analyses may simply be driven by selection effect in countries with low enrollment rates.

2.4.3 School Learning Environments

Several studies have searched for features of school learning environments that can reduce SES inequality. We grouped this research into different areas that concern quantity, quality, and emotional features of instruction and schooling as well as the social composition of the learning group.

2.4.4 Time for Learning

Some studies have related the amount of instructional time to student achievement following the sensible premise that learning something is a function of the time

allocated to learn it. Again, disadvantaged children may benefit more from additional instructional time than privileged children who receive intellectually stimulating environments anyway (e.g., private tutoring). In a recent study, Lavy (2015) proposed an interesting approach to identify the effect of instructional time that can take possible selection bias into account when analyzing pooled cross-sectional PISA 2006 data from 58 countries. The study used information on instructional time and performance which was available for mathematics, reading, and science, and exploited the within-student between-subject variation in dependent and independent variables to minimize the endogeneity bias. The analyses were replicated for students from low and highly educated parents, and suggest that there is some heterogeneity in the effect of instructional time. The effects were higher for students from low-educated parents, implying that an increase in instructional time reduces SES inequality in achievement. Burger (2016) and Schlicht et al. (2010) confirmed this finding that additional time at school reduces the effect of parental education on student achievement. They studied the cross-sectional association between annual instruction time (across all subjects) and the SES achievement gaps using PISA 2012 data from 31 European countries and PISA 2006 data from 25 European countries, respectively. Both studies revealed a negative association between the amount of time that children spent at school during a school year and the SES gap in achievement.

Sandoval-Hernández and Białowolski (2016) studied whether time spent on homework predicts academic resilience—that is, high performance despite low SES. They conducted separate analyses for five high-performing Asian countries using TIMSS 2011 grade 8 data. The authors observed that the time spent on homework was positively associated with high-performing low SES students but not for high SES students in Singapore. Although this finding suggests that homework may be able to reduce SES inequality, it seems important to bear in mind that differential effects were observed in only one of the five countries.

2.4.5 Content Coverage

Another important dimension of opportunity is the exposure to learning contents. Two studies have investigated the interaction between content coverage and SES. Schmidt, Burroughs, Zoido, and Houang (2015) used the degree to which students were exposed to formal mathematics (e.g., cosine, exponential functions) as the main explanatory variable. Student achievement was regressed on student- and school-level measures of content coverage and SES. Individual-level measures of content coverage and SES were simply aggregated by school to arrive at the school-level measures. To test for differential effects, interactions between content coverage and SES were modeled on both levels. Using PISA data from 33 OECD countries, the study reveals positive interaction effects between content coverage and Opportunity to Learn (OTL) on student and school levels. Santibañez and Fagioli (2016) replicated the finding that the interaction between SES and content

coverage predicts performance for a more diverse set of 50 countries using data from the same source study. The results from both studies suggest that content coverage is less effective for disadvantaged students, as well as for schools with a disadvantaged student body. Possible explanations for these unexpected findings are the cross-sectional design and methodological issues in the content coverage measures. In contrast to other studies, PISA does not use teacher but rather student data to measure content coverage and there are methodological issues in the wording of response scales (Scheerens, 2017; Yang Hansen & Strietholt 2018).

2.4.6 *School Culture*

Several scholars have emphasized that school culture is a determinant of student learning. Factors such as disciplinary climate, school emphasis on academic success, and a good relationship between students and teachers hinder or amplify student learning. It may be hypothesized that school culture is particularly important for disadvantaged students because they receive less parental support and grow up in a more unstable environment outside school. The existing comparative research, however, does not provide much—and sometimes counterintuitive—evidence for the assumption that a learning-oriented school culture can close the gap between low and high SES students. Sandoval-Hernández and Białowolski (2016) aimed to identify factors that support academic resilience. Using TIMSS 2011 grade 8 data from five high-performing Asian countries, four school climate variables were studied (emphasis on academic success, bullying, reinforcement by teachers, discipline). The main objective was to identify educational factors that are more effective for low SES students than for high SES students. The study provides no evidence for a heterogeneity in the effects of the four school climate variables in any of the four countries. Huang and Sebastian (2015) used PISA 2012 data to investigate a similar set of variables and, by and large, confirmed the previous neutral findings. They investigated variation in the within-school achievement gaps based on SES in 61 countries using PISA 2012 data. Since the SES gap varied statistically significantly in only 16 countries, all further analyses were replicated to this smaller subset of countries. Only two variables showed a somehow consistent relation with SES inequality: first, a positive student–teacher relationship—that is, students felt that their teachers got along with them, listened to them, and were fair, and could be approached if they needed help—was statistically significantly associated with lower within-school SES gaps in three countries and in most other countries the association was negative as well; and second, in five of the 16 countries, school discipline was significantly associated with higher SES inequality. It is, however, difficult to interpret that the achievement gaps were small in schools with problematic disciplinary climate (i.e., noise, disorder).

2.4.7 School Mix

Social segregation in the school system and measures of desegregation have been discussed for several decades. For example, transporting students by bus to schools in other districts to reduce prior racial segregation of schools (busing), ability tracking, and zoning-based school admission policies aim to influence school choice and social segregation. Several studies have used school-level SES as a predictor of performance levels but only few have related it to SES inequality in achievement. Specifically, we identified only two cross-national studies that have investigated the possibility that disadvantaged children gain more from their peers than do more advantaged children. These studies have proposed different measures of school mix. Research provides hardly any evidence that school mix is especially important for disadvantaged children.

Using PIRLS 2001 data from Germany, France, Iceland, the Netherlands, Norway, and Sweden, Ammermueller and Pischke (2009) studied the differential effects of the class mean SES on performance by SES groups. For this purpose, they regressed the achievement scores on the student-level measure number of books, the mean number of books in each classroom (social composition), and the interaction of the two variables. The data included data from more than one class per school and the authors added school fixed effects to control for unobserved confounding variables on school level. The analyses show that high SES classes perform better than low SES schools. The main finding, however, is that the interaction of student and class SES is nonsignificant in all six countries.

Chudgar et al. (2013) conceptualized school mix differently. First, they constructed a student-level SES indicator based on several possession variables (e.g., books, computer). Second, students in the bottom quartile of the national SES distribution were defined as low SES students. Third, the authors computed the absolute distance (i.e., ignoring the positive or negative sign) between the average classroom SES of all children in the classroom and the SES value of each student. The basic motivation behind this measure is that students who are closer to the average SES of their classmates may experience a less mixed environment compared to students who are further away from the average SES of their classmates. The final analytical model is regression of achievement on the dummy for low SES students, the distance measure, and their interaction. The model also contains school fixed effects. TIMSS 2007 grade 8 data were used to replicate the analyses in 15 countries. The main result is a positive main effect of the distance measure but a negative interaction in virtually all countries. This finding indicates that studying in diverse classrooms is beneficial for privileged students but not for low SES students.

2.4.8 Differentiation

Differentiation (or stratification) is one of the most contentious institutional features of educational systems. While some countries stream children into different ability

schools after primary school, others keep their secondary school system comprehensive. A frequent argument against differentiation is that educational transitions depend mainly not on ability but on SES (parental assumptions and tastes). There is compelling evidence that early tracking increases SES achievement inequality. In contrast to the research on external (between-school) differentiation, only one study investigated the effect of internal (within-school course-by-course) differentiation, finding mostly no effect on SES inequality.

The most often used indicator of differentiation is the age of first selection in the education system. This indicator is also referred to as early tracking. The most reliable evidence comes from studies that compare SES achievement gaps in primary and secondary school in tracked and untracked educational systems; as such, a design has similar methodological advantages to other longitudinal designs. Dupriez and Dumay (2006) combined primary and secondary school data for 15 European countries that participated in both PIRLS 2001 and PISA 2000. To quantify the degree of differentiation, the age of first tracking was used. In the same vein, (Lavrijsen & Nicaise, 2015) combined PIRLS 2006 and PIRLS 2012 data from 33 countries. Both studies reveal a negative effect of the age of tracking SES gaps, which suggests that tracking increases SES gaps.

Some studies compare SES inequality in secondary school in tracked and untracked educational systems without controlling for initial levels of inequality. Even though studies with such a design arguably permit less strong claims, their results on the effects of early tracking are consistent with studies that exploit longitudinal variation in SES gaps. Higher SES gaps were found in early tracking countries using data from various cycles of TIMSS (Schütz et al., 2008) and PISA (Brunello & Checchi, 2007; Horn, 2009; Le Donne, 2014; Schlicht et al., 2010). The results are less conclusive for alternative indicators of differentiation, namely, the number of tracks (school types) for the 15-year-olds, the share of upper secondary students who are enrolled in vocational programs, and course-by-course tracking within schools (Horn, 2009; Huang & Sebastian, 2015; Le Donne, 2014). These findings may suggest that it is not differentiation per se but rather between-school tracking at a very early age that exacerbates SES inequalities.

2.4.9 Accountability

Accountability concerns measures to hold educational actors accountable for their performance. There are mixed assumptions about how accountability affects SES inequality. Central examinations, for example, may decrease achievement gaps because they establish transparent criteria for performance and such information may be particularly useful for low educated parents who have more limited information about the educational system and the performance of their children. Critics of accountability systems, on the other hand, are concerned that teachers and schools may try to remove poor-performing disadvantaged children to improve their results. The evidence from comparative studies is inconclusive for various accountability measures.

To investigate effects of the existence of curriculum-based external exit examination systems that are compulsory for all students, Woessmann (2005) used a large sample of 54 countries that participated in TIMSS 1995 or 1999 (grade 8) and a more homogeneous sample of 31 OECD countries. Central exams were associated with smaller gaps between children from educated and uneducated parents for TIMSS but with larger gaps for PISA data. For the number of books SES indicator, the effects were mostly neutral. Horn (2009) and Han (2018) replicated the analyses for OECD countries using data from the more recent PISA 2009 and 2012 cycles. They observed no association between the existence of national exams and SES (measured by the ESCS index) achievement gaps.

The mere existence of exams may not be effective unless there are actual consequences for educational actors. Horn (2009) used a broad index to measure whether achievement data is communicated to various actors (parents, local community, higher level) and used by parents to choose schools, or by authorities to reward or sanction schools. This index was measured on the country level. The analyses of PISA 2009 data from 29 countries suggest no relation between SES inequality and the usage of achievement data. Gándara and Randall (2015) used PISA 2006 data from Australia, Korea, Portugal, and the United States to investigate a similar issue on school level. Principals were asked if they inform parents about the performance of their children, if school achievement data is posted publicly, and if such data is used to evaluate teachers' or principals' performance; all this information was summarized into a single score of school accountability. The study suggests a positive association between the principals' perception of school accountability and SES inequality within their schools. This finding implies that accountability increases SES gaps. Woessmann (2011) argues the performance-related payment system motivates current teachers. He studied whether the existence of a payment system that rewards outstanding teacher performance affects SES gaps using PISA 2003 data from 27 OECD countries. The study finds positive effects for the main effect of teacher performance pay and the interaction with student SES on student achievement. These findings suggest that performance pay systems do indeed have an effect on student learning but the currently existing systems apparently do not motivate teachers to support specifically disadvantaged students. Current performance pay systems thus lead to larger SES performance gaps.

School inspection is another approach to evaluate schools and there is mixed evidence.

Horn (2009) used OECD data from PISA 2003 to compare 16 countries with and 10 countries without a national inspectorate. The analyses reveal no differences in the SES achievement gaps. Witschge and van de Werfhorst (2015) used data from the ICCS from 2009 to study SES inequality in civic knowledge; that is, students' knowledge and skills of reasoning and analysis of civic systems, principals, participation, and identities. The authors compared 23 countries with and without an external evaluation system where external evaluators report to a local, regional, or central education authority. The main finding are larger within-school SES gaps in countries with an external evaluation system.

2.4.10 Interaction Between Differentiation and Accountability

Central exams may hold schools accountable for their performance, which may encourage them to allocate students to tracks, not on the basis of SES. Bol, Witschge, Van de Werfhorst, and Dronkers (2014) discuss the relationship between differentiation and accountability and argue that educational tracking may be less problematic if countries implement measures to ensure that the selection into different tracks depends mainly on merit but not on SES. Specifically, they hypothesized that SES has a larger effect on student achievement in tracked systems without central examinations, whereas this relationship is attenuated in tracked systems with central examinations. Analyses based on PISA 2009 data from 36 developed countries confirmed a significant negative triple-interaction between SES, central exams, and tracking. This finding suggests that central examinations reduce the effect of early tracking on SES inequality.

In another contribution, Bodovski et al. (2017) conducted similar analyses on the interaction between institutional features using a sample of 8th-grade data from four TIMSS cycles (1999, 2003, 2007, 2011) and 37 countries. Like Bol and colleagues, they considered tracking as one institutional feature. However, in contrast to Bol et al., the second variable is no pure measure of accountability but a combined measure of the existence of central exams, national curriculum, and centrally prescribed textbooks. The study suggests a negative effect on the interaction of the two institutional features but the parameter does not reach statistical significance. The lack of significance may be due to the ambiguous second measure which is no pure measure of accountability.

2.4.11 Autonomy

Autonomy is a key feature of the new public management regime. Proponents of autonomy argue that giving local actors more freedom in how they manage the school and their staff increases efficiency. Critics of this system fear that the lack of standardization may result in a system of unequal schools that mainly serves children from privileged backgrounds.

Studies that use concrete measures of autonomy observe positive associations between school autonomy and SES inequality. Han (2018) used the pooled PISA 2012 data from 34 OECD countries to investigate autonomy in teacher hiring and achievement inequality. She classified the mode of decision-making in teacher hiring into three levels: fully school-based teacher hiring; shared hiring decisions by school and external authority; and fully external authority-based hiring. The smallest SES gaps were observed in countries where schools have no autonomy over teacher hiring. Horn (2009) computed the ratio of principals who report autonomy in staffing, budgeting, instructional content, and assessment practices for 28 countries

using data from the PISA 2003 school questionnaire. This measure of school autonomy suggests higher SES inequality in countries with autonomous schools.

Centralization is the counterpart of autonomy. However, in contrast to the research on school autonomy, the research on centralization finds no associations between indicators of centralization and the level of SES inequality. Horn (2009) also computed the ratio of principals who report direct national or regional influence on staffing, budgeting, instructional content, and assessment practices as a measure of centralization. Witschge and van de Werfhorst (2015) used the existence of guidelines on how to assess students' active participation in school or in the community and the existence of national curricula and standards in civic education as indicators of centralization when analyzing ICCS data from 20 to 23 countries. A possible explanation for the neutral findings for centralization is that the measures used in previous research are poor indicators in comparative studies.

2.4.12 Private Schools and Competition Among Schools

Private schools may be more able to introduce new pedagogical concepts than public schools and they may be more effective because parents, teachers, principals, and the school board have shared values about education. Furthermore, private schools sometimes acquire additional resources from sponsors or by charging school fees. From a systemic perspective, private schools introduce competition among schools. With respect to social inequality in achievement, critics are particularly concerned that children from advantaged backgrounds are more likely to be schooled at private schools while disadvantaged children are schooled at public schools with less resources.

Analyses of country-level data have found no or even moderately negative associations between the share of private schools and SES inequality in achievement. This finding has been constantly replicated in studies that used data from a large set of countries and multiple cycles of TIMSS (grade 8; Bodovski et al., 2017; Schütz et al., 2008) and PISA (Burger, 2016; Schlicht et al., 2010). Two studies conducted additional analyses to test specifically the role of private funding. Schütz et al. (2008) found that a higher proportion of private sources of funds for educational institutions is associated with larger SES gaps. Another measure of private funding is the share of schools with fees in a country. PISA data suggests that SES achievement gaps are larger in countries with a high share of schools with fees (Le Donné, 2014). A tentative interpretation of the research findings is that private schools introduce new pedagogical concepts that narrow SES gaps *if* they are publicly funded. Private funding and school fees, on the other hand, introduce a barrier for poor families that increases social segregation and reinforces SES inequality in achievement.

Another research strand compared private and public schools within countries. A particularly interesting study has used longitudinal data of the Second International Mathematics Study (SIMS; 13–14-year-old students) which was conducted in 1980–1982. The 13–14-year-old students were tested in the beginning

and at the end of the school year. Toma (1996) compared SES achievement gaps in public and private schools in Belgium, France, New Zealand, Canada, and the United States. Gain scores were regressed on indicators for private schools (vs. public), SES, and their interaction. The analyses suggest statistically significant interaction effects only in France and New Zealand where the main effects of private schools were positive, but their interaction was negative. This finding suggests that the superior achievement effects of private schooling are less for higher SES students than for lower ones. In further analyses, Zimmer and Toma (2000) used the same data to compare achievement gains in high and low SES schools in public and private schools. For this purpose, they computed the average parental education and occupation for each school. They estimated a model for the pooled data, not separate models for each country. The results for the school level, however, were similar to those for SES gaps on student level. The two main effects were positive but their interaction was negative. This finding implies that the achievement gaps between low and high SES schools were smaller among private schools compared to public schools. Jehangir, Glas, and van den Berg (2015) did not use longitudinal but cross-sectional PISA 2009 data to compare SES gaps at public and private schools in eight economically diverse countries from different world regions. In two countries, the gaps were larger in public schools, and in six there were no differences.

2.4.13 Public Expenditure on Education

Public educational expenditure and SES inequality in performance may be associated because low public investment is substituted by high private investment (e.g., private tutoring). Well-educated and rich parents may invest more in education because they value education more and have more resources than parents with low SES. High public investment may also send the symbolic policy message that education is important. While well-educated parents tend to value education anyway, such a message may be particularly important for less educated families.

International studies have consistently replicated the finding that high public expenditure is associated with low SES inequality in performance. The per capita educational expenditure, whether in purchasing power standards or as a percentage of total governmental expenditure, is negatively correlated with the SES achievement gap observed in TIMSS and PISA. Such a negative correlation has been observed for diverse samples of countries around the world (Akiba et al., 2007; Bodovski et al., 2017) and in more homogeneous samples of European (Schlicht et al., 2010) or Middle East and North African (Salehi-Isfahani, Hassine, & Assaad, 2013) countries. The negative association between public expenditure and SES inequality in achievement vanishes in studies that fail to take into account the countries' economic development by using the actual value of expenditures on public education (Salehi-Isfahani et al., 2013; Schütz et al., 2008).

2.4.14 *Teacher Qualification*

Educationalists frequently emphasize the role of teachers in learning. It seems natural to investigate if an unequal distribution of teaching quality is related to achievement gaps. Well-trained teachers may be particularly able to adapt to the needs of disadvantaged students who receive less parental support than advantaged children. Furthermore, teacher quality may mediate the effects of other institutional features on SES achievement inequality in performance (e.g., the most qualified teachers may cluster in the most prestigious track in a tracked system). The research findings from previous comparative studies are inconsistent.

Akiba et al. (2007) used TIMSS 2003 grade 8 data from 46 countries to compare educational systems with needs-based and unequal access to qualified teachers. Teaching certificates, mathematics as major, mathematics education as major, and teaching experience were used to measure teaching quality. In needs-based systems, disadvantaged children have greater access to qualified teachers, and in unequal systems vice versa. The analyses reveal that the SES achievement gaps are mostly unrelated to the distribution of teaching quality. The only exception was observed for access to teachers with a major in mathematics; the SES achievement gaps were higher in countries where advantaged children have greater access to teachers with a major in mathematics.

Effects of teacher qualifications have also been studied at both school and class level. Chiu (2015) used the pooled PISA 2009 data from 65 countries to investigate the effect of teacher education on social inequality in student performance. The study shows that SES gaps in achievement are larger in schools with a higher share of teachers with university degrees. This finding suggests that students with more cultural capital benefit more from teachers with university degrees, compared to other students. Luschei and Chudgar (2011) used TIMSS 2003 data from 25 economically diverse countries around the world to study teacher quality at classroom level. They estimated the interaction effect of various teacher characteristics (teacher gender, experience, degree, and competence) and SES on student performance at the end of primary school. The interaction effects were mostly neutral. Only a few parameters reached the level of statistical significance, but there were no consistent patterns across countries. This finding suggests that teacher characteristics are equally important for students of different SES.

2.4.15 *Additional Results*

Apart from the areas we have discussed so far, studies have been conducted on rather specific issues of education. Falck et al. (2018) used grade 4 (53 countries) and grade 8 (30 countries) data from TIMSS 2011 to investigate computer use in classrooms. The authors exploited the within-student between-subject variation in different computer usages in mathematics and science to circumvent bias from unobserved

student and school characteristics. The results from the main analyses suggest that using computers to look up ideas and information has a positive effect on achievement, while using them to practice skills and procedures does not. Further analyses of different SES groups suggest that both positive and negative effects were more pronounced for high SES students. This finding suggests that using computers to look up information increases SES achievement inequality, while using them to practice skills narrows the SES gap. Pöder, Lauri, and Veski (2016) use pooled PISA 2009 data from Estonia, Finland, and Sweden to compare whether different school admission policies translate into SES inequality in achievement. The main school-level explanatory variables were whether schools prioritize student admission by zoning (i.e., walking distance) or performance (i.e., past record). The main finding is that student admission by zoning is associated with lower SES gaps while student admission by performance is associated with higher SES gaps; however, these results are not very robust in robustness checks. Huang and Sebastian (2015) tested whether instructional leadership (e.g., developing professional development programs for instructionally weak teachers) and teacher leadership (e.g., teacher involvement in management decisions) predict SES inequality within schools. The analyses were replicated for 16 countries using PISA 2012 data. Both leadership variables were unrelated to the size of the school SES gaps in all 16 countries. Schlicht et al. (2010) investigated the relation between the average class size (pupil–teacher ratio) and SES achievement gap using the pooled PISA 2006 data from EU member states, of which 10 are Eastern countries with a communist legacy and 15 Western democracies. The study suggests that the association was positive in Eastern but negative in Western countries. This finding suggests that the SES gaps are smaller in Western countries with large average classes and vice versa in Eastern countries. The contradictory findings for the Western countries may, however, be due to an outlier in the small sample of countries.

2.5 Conclusions

International comparative research on the determinants of SES inequality in student achievement constitutes a relatively new approach to understand the emergence of performance gaps. There are still a manageable number of studies that applied this approach, and the selection of studies included in the present review may be overly optimistic as we did not apply strict inclusion criteria in terms of research designs. The studies we considered here sought to identify the effects of the various determinants of SES inequality. In fact, most of the existing research we synthesized is descriptive in nature, estimating simple correlations based on cross-sectional data. While we by no means want to criticize the authors for their pioneering work in an emerging field, we still should be cautious in the interpretation of the findings. At the same time, it seems worth mentioning some praiseworthy examples of studies where the authors developed quasi-experimental approaches to address selection bias, unobserved confounding variables, and other

issues related to the identification of causal effects of determinants of SES inequality (for a more general discussion see Hanushek & Woessmann, 2011; Strietholt et al., 2014; Strietholt & Scherer, 2017). Such studies analyzed panel data (Toma, 1996; Zimmer & Toma, 2000), exploited within-student between-subject variation (Falck et al., 2018; Lavy, 2015), or combined different educational stages from various source studies (Dupriez & Dumay, 2006; Lavrijsen & Nicaise, 2015). At the same time, there is an ongoing debate on the limitations of combining certain test scores from international assessments (e.g., Jerrim, Lopez-Agudo, Marcenaro-Gutierrez, & Shure, 2017; Lockheed & Wagemaker, 2013).

Further methodological issues related to the reproducibility and generalizability of research findings. While these issues are certainly no distinctive feature of comparative studies (Open Science Collaboration, 2015) it seems pertinent to acknowledge some limitations of the international comparative research. The limited number of countries is a natural limitation of this approach. While the accumulated data from international assessment comprises data from about 100 countries, several studies we reviewed exploited data from only a few countries or were limited to certain regions (e.g. OECD, European, Northern countries). Another limitation relates to the representation of different educational stages in the research we reviewed. Only a handful of studies investigated SES achievement inequality at the end of primary school while most were about inequality in secondary school. From a policy perspective, it may be most efficient to prevent the emergence inequalities at an early stage. Thus, further research on primary school (or even earlier) is needed.

Despite the fact that it is inherently difficult to identify determinants of SES inequality, we would like to point to some tentative lessons learned. First, we repeatedly found that opportunity of choice reinforced inequality. SES inequality in achievement is higher in countries where preschool is not compulsory but voluntary, different tracks exist, the share of public funding is low, and private schools charge fees. Second, policies that narrow down choice reduce SES inequality. Preschool does not reinforce but rather reduces SES inequality if the preschool system serves not only a few but all children (i.e., also the disadvantaged). Tracking seems to be less problematic if countries implement measures to ensure that the selection into prestigious tracks depends mainly on merits but not on SES. A larger share of private funding and private schools with fees are associated with larger SES effects on achievement. In contrast to the country-level features that constitute an institutional framework for learning, there is little evidence regarding how to arrange school learning environments to reduce social inequality. The effects of school and classroom variables are mixed, and sometimes unexpected. However, the aforementioned methodological issue may explain at least some of the inconsistencies in the findings observed in previous research. Further research is needed, but we are confident that we are currently witnessing the emergence of a promising research approach that will help us to understand and influence the emergence of SES inequality in achievement.

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References

- (* indicate that findings from the references were used in the present review)
- * Akiba, M., LeTendre, G. K., & Scribner, J. P. (2007). Teacher quality, opportunity gap, and national achievement in 46 countries. *Educational Researcher*, 36(7), 369–387. <https://doi.org/10.3102/0013189x07308739>.
 - * Ammermueller, A., & Pischke, J. S. (2009). Peer effects in European primary schools: Evidence from the progress in international reading literacy study. *Journal of Labor Economics*, 27(3), 315–348. <https://doi.org/10.1086/603650>.
 - * Araújo, L., & Costa, P. (2015). Home book reading and reading achievement in EU countries: The progress in international reading literacy study 2011 (PIRLS). *Educational Research and Evaluation*, 21(5–6), 438.
 - * Bodovski, K., Byun, S. Y., Chykina, V., & Chung, H. J. (2017). Searching for the golden model of education: Cross-national analysis of math achievement. *Compare*, 47(5), 722–741. <https://doi.org/10.1080/03057925.2016.1274881>.
 - * Bol, T., Witschge, J., Van de Werfhorst, H. G., & Dronkers, J. (2014). Curricular tracking and central examinations: Counterbalancing the Impact of social background on student achievement in 36 countries. *Social Forces*, 92(4), 1545–1572. <https://doi.org/10.1093/sf/sou003>.
 - * Brunello, G., & Checchi, D. (2007). Does school tracking affect equality of opportunity? New international evidence. *Economic Policy*, 22(52), 781–861. doi: <http://www.jstor.org/stable/4502215>.
 - * Burger, K. (2016). Intergenerational transmission of education in Europe: Do more comprehensive education systems reduce social gradients in student achievement? *Research in Social Stratification and Mobility*, 44, 54–67. <https://doi.org/10.1016/j.rssm.2016.02.002>.
 - * Caro, D. H., & Lenkeit, J. (2012). An analytical approach to study educational inequalities: 10 hypothesis tests in PIRLS 2006. *International Journal of Research & Method in Education*, 35(1), 30.
 - * Cebolla-Boado, H., Radl, J., & Salazar, L. (2016). Preschool education as the great equalizer? A cross-country study into the sources of inequality in reading competence. *Acta Sociologica*, 60(1), 41–60. <https://doi.org/10.1177/0001699316654529>.
 - * Chiu, M. M. (2015). Family inequality, school inequalities, and mathematics achievement in 65 countries: Microeconomic mechanisms of rent seeking and diminishing marginal returns. *Teachers College Record*, 117(1), 1–32.
 - * Chudgar, A., Luschei, T. F., & Zhou, Y. (2013). Science and mathematics achievement and the importance of classroom composition: Multicountry analysis using TIMSS 2007. *American Journal of Education*, 119(2), 295–316. <https://doi.org/10.1086/668764>.
 - Duncan, O. D., Featherman, D. L., & Duncan, B. (1972). *Socio-economic background and achievement*. New York: Seminar Press.
 - * Dupriez, V., & Dumay, X. (2006). Inequalities in school systems: Effect of school structure or of society structure? *Comparative Education*, 42(2), 243–260. <https://doi.org/10.1080/03050060600628074>.
 - * Falck, O., Mang, C., & Woessmann, L. (2018). Virtually no effect? Different uses of classroom computers and their effect on student achievement. *Oxford Bulletin of Economics and Statistics*, 80(1), 1–38. <https://doi.org/10.1111/obes.12192>.

- * Gándara, F., & Randall, J. (2015). Investigating the relationship between school-level accountability practices and science achievement. *Education Policy Analysis Archives*, 23. <https://doi.org/10.14507/epaa.v23.2013>.
- Gottfried, A. (1985). Measures of socioeconomic status in child development research: Data and recommendations. *Merrill-Palmer Quarterly*, 31(1), 85–92.
- * Han, S. W. (2018). School-based teacher hiring and achievement inequality: A comparative perspective. *International Journal of Educational Development*, 61, 82–91. <https://doi.org/10.1016/j.ijedudev.2017.12.004>.
- Hanushek, E. A., & Woessmann, L. (2011). The economics of international differences in educational achievement. In E. A. Hanushek, S. Machin, & L. Woessmann (Eds.), *Handbook of the economics of education* (Vol. 3). Amsterdam: Elsevier.
- Hauser, R. M. (1994). Measuring socioeconomic status in studies of child development. *Child Development*, 65(6), 1541–1545.
- Heyneman, S. P., & Loxley, W. A. (1983). The effect of primary-school quality on academic achievement across twenty-nine high-and low-income countries. *Journal of Sociology*, 88(6), 1162–1194.
- Hogrebe, N., & Strietholt, R. (2016). Does non-participation in preschool affect children's reading achievement? International evidence from propensity score analyses. *Large-scale Assessments in Education*, 4(1). <https://doi.org/10.1186/s40536-016-0017-3>.
- * Horn, D. (2009). Age of selection counts: A cross-country analysis of educational institutions. *Educational Research and Evaluation*, 15(4), 343–366. <https://doi.org/10.1080/13803610903087011>.
- * Huang, H. G., & Sebastian, J. (2015). The role of schools in bridging within-school achievement gaps based on socioeconomic status: A cross-national comparative study. *Compare—A Journal of Comparative and International Education*, 45(4), 501–525. <https://doi.org/10.1080/03057925.2014.905103>.
- * Jehangir, K., Glas, C. A. W., & van den Berg, S. (2015). Exploring the relation between socio-economic status and reading achievement in PISA 2009 through an intercepts-and-slopes-as-outcomes paradigm. *International Journal of Educational Research*, 71, 1–15. <https://doi.org/10.1016/j.ijer.2015.02.002>.
- Jerrim, J., Lopez-Agudo, L. A., Marcenaro-Gutierrez, O. D., & Shure, N. (2017). What happens when econometrics and psychometrics collide? An example using the PISA data. *Economics of Education Review*, 61, 51–58. <https://doi.org/10.1016/j.econedurev.2017.09.007>.
- * Lavrijsen, J., & Nicaise, I. (2015). New empirical evidence on the effect of educational tracking on social inequalities in reading achievement. *European Educational Research Journal*, 14(3–4), 206–221. <https://doi.org/10.1177/1474904115589039>.
- * Lavy, V. (2015). Do differences in schools' instruction time explain international achievement gaps? Evidence from developed and developing countries. *The Economic Journal*, 125(588), F397–F424. <https://doi.org/10.1111/eoj.12233>.
- * Le Donné, N. (2014). European variations in socioeconomic inequalities in students' cognitive achievement: The role of educational policies. *European Sociological Review*, 30(3), 329–343. <https://doi.org/10.1093/esr/fcu040>.
- Lockheed, M. E., & Wagemaker, H. (2013). International large-scale assessments: Thermometers, whips or useful policy tools? *Research in Comparative and International Education*, 8(3), 296–306. <https://doi.org/10.2304/rcie.2013.8.3.296>.
- * Luschei, T. F., & Chudgar, A. (2011). Teachers, student achievement and national income: A cross-national examination of relationships and interactions. *Prospects*, 41(4), 507–533. <https://doi.org/10.1007/s1125-011-9213-7>.
- Meyer, H. D., Strietholt, R., & Epstein, D. Y. (2018). Three models of global education quality and the emerging democratic deficit in global education governance. In M. Akiba & G. K. LeTendre (Eds.), *Routledge international handbook of teacher quality and policy*. New York: Routledge.
- Mueller, C. W., & Parcel, T. L. (1981). Measures of socioeconomic status: Alternatives and recommendations. *Child Development*, 52(1), 12–30.

- Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, 349(6251), aac4716. <https://doi.org/10.1126/science.aac4716>.
- * Park, H. (2008). The varied educational effects of parent-child communication: A comparative study of fourteen countries. *Comparative Education Review*, 52(2), 219–243. <https://doi.org/10.1086/528763>.
- * Pöder, K., Lauri, T., & Veski, A. (2016). Does school admission by Zoning affect educational inequality? A study of family background effect in Estonia, Finland, and Sweden. *Scandinavian Journal of Educational Research*, 61(6), 668–688. <https://doi.org/10.1080/00313831.2016.1173094>.
- * Salehi-Isfahani, D., Hassine, N., & Assaad, R. (2013). Equality of opportunity in educational achievement in the Middle East and North Africa. *The Journal of Economic Inequality*, 12(4), 489–515. <https://doi.org/10.1007/s10888-013-9263-6>.
- * Sandoval-Hernández, A., & Białowolski, P. (2016). Factors and conditions promoting academic resilience: A TIMSS-based analysis of five Asian education systems. *Asia Pacific Education Review*, 17(3), 511–520. <https://doi.org/10.1007/s12564-016-9447-4>.
- * Santibañez, L., & Fagioli, L. (2016). Nothing succeeds like success? Equity, student outcomes, and opportunity to learn in high- and middle-income countries. *International Journal of Behavioral Development*, 40(6), 517–525. <https://doi.org/10.1177/0165025416642050>.
- Scheerens, J. (2017). *Opportunity to learn, curriculum alignment and test preparation*. Berlin: Springer.
- * Schlicht, R., Stadelmann-Steffen, I., & Freitag, M. (2010). Educational inequality in the EU the effectiveness of the national education policy. *European Union Politics*, 11(1), 29–60. <https://doi.org/10.1177/1465116509346387>.
- * Schmidt, W. H., Burroughs, N. A., Zoido, P., & Houang, R. T. (2015). The role of schooling in perpetuating educational inequality: An international perspective. *Educational Researcher*, 44(7), 371–386. <https://doi.org/10.3102/0013189x15603982>.
- * Schütz, G., Ursprung, H. W., & Woessmann, L. (2008). Education policy and equality of opportunity. *Kyklos*, 61(2), 279–308. <https://doi.org/10.1111/j.1467-6435.2008.00402.x>.
- Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research*, 75(3), 417–453. <https://doi.org/10.3102/00346543075003417>.
- Strietholt, R., Gustafsson, J. E., Rosén, M., & Bos, W. (2014). Outcomes and causal inference in international comparative assessments. In E. Policy (Ed.), *Educational policy evaluation through international comparative assessments*. Münster/New York: Waxmann.
- Strietholt, R., & Scherer, R. (2017). The contribution of international large-scale assessments to educational research: Combining individual and institutional data sources. *Scandinavian Journal of Educational Research*, 1–18. <https://doi.org/10.1080/00313831.2016.1258729>.
- * Toma, E. (1996). Public funding and private schooling across countries. *Journal of Law and Economics*, 9(1), 121–148.
- Van de Werfhorst, H. G., & Mijs, J. J. B. (2010). Achievement Inequality and the Institutional Structure of Educational Systems: A Comparative Perspective. *Annual Review of Sociology*, 36(1), 407–428. <https://doi.org/10.1146/annurev.soc.012809.102538>.
- White, K. R. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin*, 91(3), 461–481. <https://doi.org/10.1037/0033-2909.91.3.461>.
- * Witschge, J., & van de Werfhorst, H. G. (2015). Standardization of lower secondary civic education and inequality of the civic and political engagement of students. *School Effectiveness and School Improvement*, 27(3), 367–384. <https://doi.org/10.1080/09243453.2015.1068817>.
- * Woessmann, L. (2005). The effect heterogeneity of central examinations: Evidence from TIMSS, TIMSS—Repeat and PISA. *Education Economics*, 13(2), 143–169. <https://doi.org/10.1080/09645290500031165>.
- * Woessmann, L. (2011). Cross-country evidence on teacher performance pay. *Economics of Education Review*, 30(3), 404–418. <https://doi.org/10.1016/j.econedurev.2010.12.008>.

- Yang Hansen, K., & Strietholt, R. (2018). Does schooling actually perpetuate educational inequality in mathematics performance? A validity question on the measures of opportunity to learn in PISA. *Zdm*, *50*(4), 643–658. <https://doi.org/10.1007/s11858-018-0935-3>.
- * Zimmer, R., & Toma, E. (2000). Peer effects in private and public schools across countries. *Journal of Policy Analysis and Management*, *19*(1), 75–92.