Does Schooling Increase or Reduce Social Inequality?

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Abstract

Does experience in school increase or reduce social inequality in skills? Sociologists have long debated this question. Drawing from the counterfactual account of causality, we propose that the impact of going to school on a given skill depends on the quality of the instructional regime a child will experience at school compared with the quality of the instructional regime the child would receive if not at school. Children vary in their benefit from new instruction, and current skill increases this benefit. We hypothesize that the expansion of free, universal schooling promotes social equality in part by equalizing access to school, but also because disadvantaged children benefit more from access. However, we predict that this equalizing effect will be more pronounced for younger children than for older children. To test these hypotheses, we review empirical evidence regarding the impact of (*a*) increasing access to universal kindergarten and preschool, (*b*) interrupting schooling with the summer recess, (*c*) extending the school day, and (*d*) extending years of compulsory schooling. We consider implications for the potential of school reform to reduce educational inequality.

INTRODUCTION

In this article we revisit an enduring question in educational sociology, Does experience in school increase or reduce social inequality? Since passage of the Elementary and Secondary Education Act in 1965, the key aim of US education policy has been to reduce social inequality in educational opportunity. Reauthorization of this Act in 2002 mandated strong sanctions against schools that failed to exhibit high test scores for low-income and minority children. Yet there is little doubt that educational inequality in contemporary US society remains large and has been for at least a century (Gamoran 2001). Indeed, social inequality in cognitive test scores may be growing even faster than might be predicted by the rapid increase in income inequality (Reardon 2011). The striking contrast between the aims of US policy and these results has motivated serious doubt about the assumption that public schooling can reduce social inequality.

Some critics deny that schools can have much effect on inequality in a world where enduring economic, neighborhood, and family inequality undermines effective school reform (Rothstein 2004). Others assert that schools play a powerful role in society, but one that reinforces rather than reduces inequality (Bowles & Gintis 1976, 2002). In this view, elementary-school ability grouping and high-school tracking promote unequal learning opportunities. The disproportionate placement of low-income and minority children in low-ability groups and tracks is alleged to help reproduce inequality across the generations (Oakes 1985).

Implicit causal inferences drive this passionate debate. Public schooling is a weak or strong force for good or ill! Proponents of each view cite statistics to support their causal claims, but the validity of these inferences remains open to challenge.

Absent from the debate is a causal framework for explicitly stating and evaluating claims about the contribution of schooling to social inequality. In this article, we propose such a framework and use it to review empirical evidence regarding the impact of four interventions studied over the past century: (*a*) providing free, universal kindergarten or preschool; (*b*) interrupting schooling with the summer recess; (*c*) extending the school day; and (*d*) extending years of compulsory schooling. We have chosen these natural experiments because researchers have exploited them to draw plausible causal inferences about the impact of universal public schooling on student skills. Under comparatively mild assumptions about selection bias, we use these studies to assess the impact of attending school on students who vary in social background.

According to our model, each child experiences a unique learning environment if attending school—one that contrasts with the learning environment the child would experience if not attending school.[1] We call such environments instructional regimes (Raudenbush 2008). For young persons, every social environment offers opportunities to learn, even if the instruction thus provided is not self-conscious. We thus conceive "instruction" broadly to include all aspects of a learning environment. Our aim in using the single word "skills" to refer to a broad range of knowledge, dispositions, and capacities is to keep the language simple.

The causal effect of attending school on a given skill is then the child-specific difference between two potential outcomes, one associated with the instructional regime at school and the other associated with the instructional regime if not attending school. The impact of attending school works strictly through the contrast between these two instructional regimes.

Our model assumes heterogeneity in children's responses to instruction. We adopt the concept of dynamic complementarity (Cunha & Heckman 2009, Heckman & Mosso 2014). When children

[1] We are thus working with the counterfactual account of causality developed in statistics by Neyman (1935) and Rubin (1974, 1978) and in economics by Haavelmo (1943), Roy (1951), and Heckman (1976). See reviews by Holland (1986), Morgan & Winship (2007), and Heckman (2005).

gain skills early in life, their capacity to benefit from later instruction increases, implying that effective early instruction can increase the benefit of later instruction. This is consistent with Sørenson & Hallinan's (1977) hypothesis that effective home environments increase children's capacity to benefit from school. The idea that "skill begets skill" (Heckman 2000) implies that high-skill children will benefit more from a dose of instruction than low-skill children will. This implication would seem to contradict the assertion that schooling is compensatory, reducing social inequality. According to our model, however, there is no contradiction. In essence, equalizing input is compensatory even when response to input is disequalizing. To see this, one must consider the counterfactual setting in which input is not equalized. A counterfactual model that compares experience in school with experience if not in school is thus essential to understanding the tension between compensatory input and unequal gain from input, a tension that over time determines whether inequality will increase or decrease.

Our model reflects the assumption that the function of the public schooling system is to promote a common set of skills for all students. In this view, students leave the formal schooling system with wide variation in proficiency in skill; social inequality, broadly conceived, is large to the extent the social origins of the adult population predict this variation in skill. We think that this conception of the schooling system contrasts sharply with classic sociological views of the function of schooling in society, which is to appropriately differentiate the skills subsets that students will gain. We regard our conception as grounded in changes in society's expectations for formal schooling during the comparatively recent transition to a postindustrial society marked by social conflict and rapid technological change. Let us consider what might be meant by social inequality in skill before asking whether schooling increases or reduces such inequality.

WHAT IS SOCIAL EQUALITY IN EDUCATION?

A widely held belief is that the purpose of schooling is to produce skills that are useful in the labor market and for life. Influential educational policy researchers have long modeled schooling as a production process that works efficiently when the available technology and incentives enable educators to optimally transform inputs to outputs (Hanushek 1979, 2003). Like a firm that produces high profits, an efficient school generates skill often, but not always, equated with high test scores. The school promotes a common skill set for all students, though schools vary in their efficiency in promoting skills and children vary in their capacity to obtain these skills.

Efficient Stratification

Sociologists have historically taken quite different views. In a functionalist view, the purpose of schooling is efficient and meritocratic stratification. In this view, student abilities and interests vary widely, as do the skills required by widely varying occupations. Schools should help students match their varied abilities and interests to the array of roles adults play in the labor market (Davis & Moore 1945, Sorokin 1959), and develop varied skill sets that match these varied roles. Schools draw legitimacy not only from helping students obtain the relevant skills but also from accurately certifying the varied skills students obtain. As Sorokin (1959, p. 8) wrote,[2]

> At the present moment it is certain that the school, while being a 'training and educational' institution, is at the same time a piece of social machinery, which tests the abilities of the individuals, which sifts them, selects them, and decides their prospective social position.

[2]This quotation appears in Sorokin 2011 (p. 8, reprinted from Sorokin 1959).

Closely related, schools should teach children to be in society (Dreeben 1968, 1994, 2000; Parsons 1959). The classroom is thus organized as a workplace: By attending classrooms composed of same-age peers (coworkers) and interacting with the supervising teacher (the workplace supervisor), the students learn where they stand in relation to their peers, how to accept the authority of the teacher, and, ultimately, how to fulfill the differentiated roles they will play as adults. Schools thus solve the problem of adult psychological adjustment to unequal roles in the labor force by first solving the problem of pupil adjustment to unequal roles in the elementary school classroom. The comprehensive high school historically formalized this differentiation by assigning students to an academic or college-bound track, a general track, or a vocational track (Gamoran 1987), determining which children would go on to obtain a college education and which children would go directly to work.

To be efficient, such a stratification system should be based on achieved skills, not on ascriptive traits such as race, gender, or parent socioeconomic status (SES). Hence, in this view, inequality of outcomes is desirable, but so is social equality defined as a meritocracy in which adult occupational status is independent of social origin. The only exception would arise if native ability were correlated with SES; in that case, the association between SES of origin and adult SES in a truly meritocratic society should be explained entirely by innate ability, though this notion of native ability has always been contentious, and no one has solved the problem of defining and measuring it.

Differentiated Skills

In the functionalist view of the mid-twentieth century then, efficient stratification implied that, rather than teach a common set of skills, schools would promote varied skills for students destined to play varied roles in society. A college-bound track would produce high levels of reading comprehension, writing skill, mathematical problem solving, and higher-order thinking skills required for analysis, reasoning, and evaluation of alternative courses of action. The general and vocational tracks would focus on reading as decoding texts with familiar ideas and following arithmetic procedures. Nonacademic skills were similarly differentiated: College-bound students would develop curiosity, creativity, and leadership. Non-college-bound students would learn to be punctual, to follow rules, and to endure repetitive tasks.

The leftist critique of the functional model described the schooling system similarly in terms of its focus on stratification (Bowles & Gintis 1976, 2002). However, in this view, innate differences in ability were small and weakly related to variation in track placement; the hierarchy of adult statuses was peculiar to capitalism. Rather than efficiently discovering differences in abilities and interests and promoting appropriately differentiated skills, the schooling system helped reproduce inequality in each new generation. Teaching children to "be in society" was to socialize them to vast labor-market inequality and, for those destined to become low-status workers, to legitimize inequality by accepting the notion that, because of their skills and interests, they had earned their low status. For these critics, to pursue social inequality was not to advocate meritocratic inequality of outcomes but rather to unleash a transformation of schooling that would enable education to produce skills and attitudes needed to create a more just society.

Toward a Postindustrial Model

The functionalist view may be regarded as an industrial model in which stratification within schools mapped neatly onto the industrial occupational structure. Such stratification became a target of movements for civil rights and social equality in the 1960s. Even as its critics attacked it in the name of social justice, however, the tracking system eroded as the jobs for which general and vocational students were ostensibly being trained disappeared. As technological innovation

eliminated many of those jobs, it compelled educators to rethink their aims and, in doing so, to transform their notions of social inequality. The result has been a progressive homogenization of the aims of schooling.

The War on Poverty, led in 1965, made the cornerstone of federal policy the reduction of academic achievement inequality between high- and low-income students. The theory of action then was that providing extra funds to high-poverty schools would inexorably lead to more equal achievement, typically defined as test scores but also including years of attained schooling and labor-market outcomes. By the mid-1990s it was clear that this theory did not hold, and policy makers began seriously to devise ways of holding schools accountable for their outcomes (Cohen & Moffitt 2009). This impulse culminated in the No Child Left Behind Act of 2001, which held schools accountable not only for producing high mean achievement but also for enabling subgroups of students defined by family income, race, and language background to achieve at high levels. At the same time, the modern labor market appeared increasingly to require of young workers the very kinds of cognitive skills taught in the college-bound track (Murnane et al. 1995). The tendency to hold schools accountable to produce a common set of academic skills has achieved its clearest expression with the Common Core State Standards Initiative and is also revealed by high school curricular reforms that require all students to take college-preparatory mathematics (Nomi & Allensworth 2009). In essence, the Common Core expresses the goal of teaching higher-order thinking skills to all children.

The homogenization of the skills schools are expected to produce has thus given rise to a notion of social inequality that is quite different from that embedded in classic functionalist sociology. For many policy makers, practitioners, and parents, social inequality now means, primarily, that mastery of a set of common cognitive skills is associated with SES. The proposition that schools now embrace common aims for skill acquisition, though still contested, lays the basis for the causal model we propose in this article.

A SIMPLE CAUSAL MODEL

Models of schooling and social stratification have been enormously useful in sociology for at least a half century. Such models link social origins, family processes, and social networks to educational attainment, skill, and labor-market outcomes, creating a principled basis for quantifying and explaining the intergenerational transmission of social inequality in many societies (see Morgan's 2005 review). Yet our review suggests that these models can be readily misinterpreted. The missing ingredient, we shall argue, has been a model for the counterfactual outcome—the outcome we would observe if a child did not attend school. We therefore adopt the counterfactual account of causality, in which a causal effect is a comparison between two potential outcomes, each observable under an alternative course of action (Heckman 1976; Holland 1986; Neyman 1935; Roy 1951; Rubin 1974, 1978; see Morgan & Winship 2007 for a review). For a child who attends school, the counterfactual outcome is the level of skill we would have observed had the child stayed "at home."[3]

A Model for the Impact of School Attendance

At a given time, a child may or may not receive an additional dose of schooling: attending a year of preschool, an extra half day of kindergarten, a month of summer school, or an extra year of compulsory schooling, doses of schooling that we review below. So "attending school" in this

[3]To simplify the discussion, we shall say that children who are not in school are "at home," though such children might in fact be in the care of relatives or friends, spending time with peers, etc.

context means receiving a specific dose of schooling at a particular time. We define $S = 1$ if the child does attend school, $S = 0$ if not. If the child attends, we observe an outcome $Y(S = 1)$ or simply $Y(1)$, where Y is a skill, such as a reading skill, math skill, or self-regulation, that presumably is valuable for all children regardless of social background. If the child stays at home, we observe an outcome $Y(S = 0)$ or simply $Y(0)$.

The child-specific impact of attending is then $B = Y(1) - Y(0)$. We never observe B for any child because we never observe both potential outcomes: If the child attends school, we see $Y(1)$ but not $Y(0)$; if the child stays home, we see $Y(0)$ but not $Y(1)$. However, under certain assumptions, we can estimate the average causal effect of such a dose of schooling for some population or subpopulation. We use the expectation symbol E to represent a population average. The population-average causal effect, which we label β, is $E(B) = E[Y(1) - Y(0)] = \beta$.

Instruction as the key mediator. We reason that attending school can bring about an effect on skill Y only through putting in place an instructional regime that departs from the instructional regime the child would have received at home. Following Murphy (2003), we define an instructional regime as a set of rules that assign instructional practices to a child, depending on that child's current and past skill and behavior. An instructional regime is thus dynamic, as it allows an agent such as a parent or teacher to modify his or her response to a child on the basis of observations of that child's response to past input. The concept of a regime is essential; two children experiencing the same regime could experience quite different interactions with caregivers, and children experiencing similar interactions could be engaged in quite different regimes (Raudenbush 2008). Hence, within the same regime, a particular interaction (such as being taught to sound out words) might make sense for one child but not another given the current developmental status of the two children. Effective regimes are thus tailored to the current status of the child.

Of course, the regimes children experience at home or at school are not formalized; we can find no set of rules that a parent or teacher follows to guide the response to a particular child's current status. Nevertheless, parents and teachers operate in a world in which social norms, features of personality, and routinized behavior generate regularities in the treatment of children; even if an agent's behavior is somewhat inconsistent or unpredictable, we incorporate this inconsistency into our notion of the regime with which the child must contend and that will shape the emergence of skill. The idea of an instructional regime, including all aspects of an environment that shape opportunities for learning, is thus intended to be broad.

We now define Q as the quality of an instructional regime, and let $Q(S = 1) = Q(1)$ denote the quality of the regime a child experiences at school and $Q(S = 0) = Q(0)$ the quality of the regime the child receives if staying at home. For a potential new dose of schooling, the child-specific impact of attending school rather than staying home on quality of instruction is $\Gamma = Q(1) - Q(0)$, and the population-average impact of schooling on quality of instruction is $E(\Gamma) = E[Q(1) - Q(0)] = \gamma$.

So the quality of the instructional regime a child experiences, whether at home or school, is the active environmental ingredient that generates skill. To keep the model simple and to emphasize key ideas, we assume linearity: The impact of a unit increment to quality Q generates a linear increase Δ in skill.

These ideas generate a very simple, child-specific causal model for attending school (versus staying at home), displayed in **Figure 1**. [A technical review of key assumptions appears in the Appendix (see below).] Attending school generates a child-specific change Γ in instructional quality that, in turn, generates a child-specific increment (or decrement), B, in skill. In this child-specific path model, schooling influences skill only indirectly, by influencing instructional quality, defined broadly. There is no direct path between schooling and skill because our definition of instruction is broad. Symbolically, the impact of school for a given child is $B = \Gamma\Delta$.

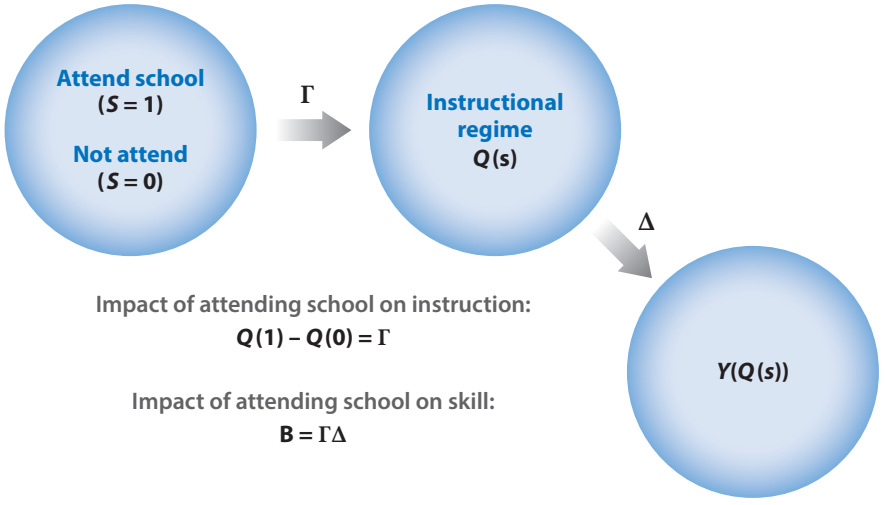

Figure 1

Counterfactual (child-specific) model.

The population-average impact of attending school (versus staying at home) is defined in **Figure 1** as

$$E(B) = E(\Gamma\Delta) = E(\Gamma)^{*}E(\Delta) + Cov(\Gamma, \Delta) \equiv \gamma\delta + \sigma_{\Gamma,\Delta}, \quad 1.$$

where γ is the population-average impact of going to school rather than staying at home on the quality of instruction, and δ is the population-average impact of instructional quality on skill. The average contribution of schooling to the average skill in a society or a subgroup is composed of two terms. The first term is $\gamma\delta$, which is high when attending school induces, on average, a large improvement in instruction (γ) and the average impact of instruction (δ) on skill is large. The second term is $Cov(\Gamma, \Delta) = \sigma_{\Gamma,\Delta}$, the covariance between child-specific Γ and Δ. This covariance term implies that the average impact of schooling on skill will be large when those who stand to benefit most from high-quality instruction (that is, those who have high values of Δ) are those who receive large increments, Γ, to instructional quality by attending school. So if children actually vary a lot with respect to the benefit, Δ, that they derive from instruction, and if resources for schooling are constrained, one can maximize the average impact of school attendance by providing an extra dose of schooling to those who stand to gain the most from it. This is a formalization of the notion of efficient stratification and is articulated by Davis & Moore (1945) and Sorokin (1959) as cited above.

Social status differences in the impact of school attendance. For simplicity, we broadly denote social origins in terms of SES, keeping in mind that multiple aspects of social origins (ethnicity, race, gender) are important aspects of social origin in addition to parent occupation, education, income, and the like. Our reasoning leads straightforwardly to a conception of the difference in the impact of schooling between high- and low-SES children:

$$\beta_{high} - \beta_{low} = \delta_{high}\gamma_{high} - \delta_{low}\gamma_{low} + \sigma_{\Gamma,\Delta,high} - \sigma_{\Gamma,\Delta,low}, \quad 2.$$

where the subscripts *high* and *low* denote two subpopulations of children, one that is high in SES and the other low. The second difference in Equation 2 is the difference $\sigma_{\Gamma,\Delta,high} - \sigma_{\Gamma,\Delta,low}$ between

high- and low-SES subpopulations with respect to the covariance between Δ and Γ. We might reason that this covariance between Γ and Δ will be particularly low for high-SES children: It might well be that high-SES children who benefit little from schooling will nonetheless experience high-quality instructional regimes. This would be true if high-SES parents were good at locating great instructional environments even if their children had learning difficulties. However, we might also reason that this covariance will be low for low-SES children: It may be that low-SES children who would benefit greatly from instruction would nonetheless experience instructional regimes similar to those of low-SES children who stood to gain less from instruction. Given that we have no clear theoretical expectation for the difference between these two covariances, we tentatively set this difference to 0. However, we consider the implications of a failure of this assumption in the concluding section.

Hence, the difference between the high- and low-SES children with respect to the impact of attending school simplifies. Applying a Oaxaca decomposition (Oaxaca 1973), we have

$$\begin{aligned}\beta_{high} - \beta_{low} &= \delta_{high}\gamma_{high} - \delta_{low}\gamma_{low} \\ &= (\gamma_{high} - \gamma_{low})\delta_{high} + \gamma_{low}(\delta_{high} - \delta_{low}).\end{aligned} \quad 3.$$

Equation 3 reveals how compensatory input and unequal gain can work together to shape inequality. If low-SES children experience a greater dose of input from going to school than high-SES children do, $\gamma_{high} - \gamma_{low}$ will be negative and therefore will tend to reduce SES inequality in the benefit of school attendance; that is, $\beta_{high} - \beta_{low}$. However, if high-SES children benefit from input more than low-SES children do, that is, $\delta_{high} - \delta_{low}$ is positive, then school attendance will tend to increase SES inequality in the benefit of school attendance. Assuming that going to school increases the quality of input for both high- and low-SES children, that is, assuming $\gamma_{high} > 0$; $\delta_{low} > 0$, access to school will reduce inequality if

$$\frac{\gamma_{low}}{\gamma_{high}} > \frac{\delta_{high}}{\delta_{low}}\gamma_{high} > 0; \quad \delta_{low} > 0, \quad 4.$$

that is, if the compensatory effect of equalizing input exceeds the disequalizing effect of differential gain.

A Model for the Impact of Access to Schooling

To complete the picture, we need to embed our model for the impact of school attendance within a model for access to schooling. In early research on status attainment (Blau & Duncan 1967), researchers proposed a simple path model of the form shown in **Figure 2**. Here π_{high} is the probability of attending school (or, in our case, getting an extra dose of schooling) for high-SES children and π_{low} is the probability of attending school for low-SES children; β is the impact of attending school, and $\theta_{home,\,high} - \theta_{home,\,low}$ is the direct effect of SES on skill, which is generated by experience outside of school ("at home").

A key feature of this classic model is the assumption of a constant impact β of attending school. Critics reasoned that school quality varied as a function of SES; hence, high-SES kids, who attend higher-quality schools, should benefit more from a year of schooling than low-SES kids would. Applying the Oaxaca decomposition (Oaxaca 1973), we thence revise the model, as shown in **Figure 3**.

In **Figure 3**, the impact of a year of schooling is β_{low} for low-SES students and β_{high} for high-SES students. According to this model, if we were to equalize access to a dose of schooling for high- and low-SES students such that each group had the same probability of school attendance

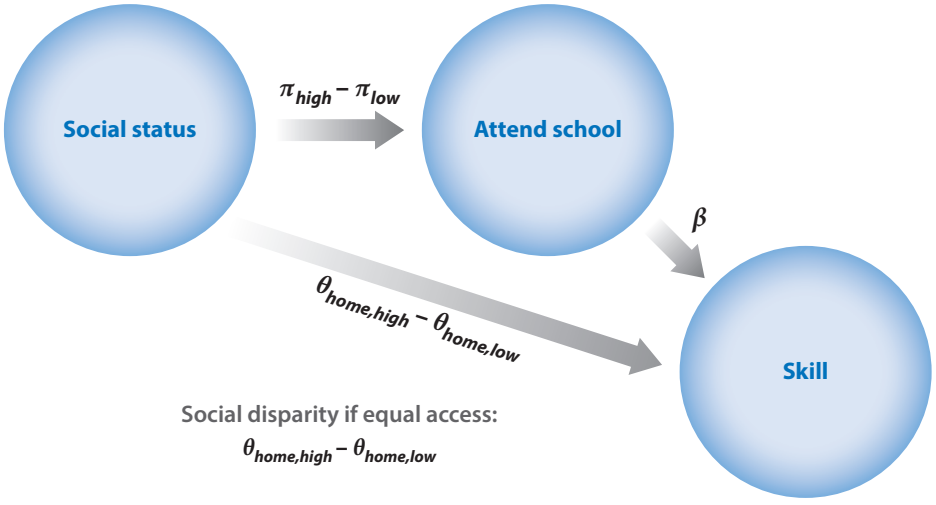

Figure 2

Classic status attainment model for schooling.

$\pi_{high} = \pi_{low} = \pi$, the remaining SES disparity in skill would be

$$\theta_{home,\,high} - \theta_{home,\,low} + (\beta_{high} - \beta_{low})\pi. \qquad 5.$$

Thus, SES inequality would represent not only the differential impact of home environment, that is, $\theta_{home,\,high} - \theta_{home,\,low}$, but also the differential benefit that high-SES students receive, on average, from attending a year of schooling, that is, $(\beta_{high} - \beta_{low})$ multiplied by the fraction π of students who attend. It is tempting to assume that the differential effect of schooling represents the disparity in quality of school environments experienced by high- and low-SES children, on

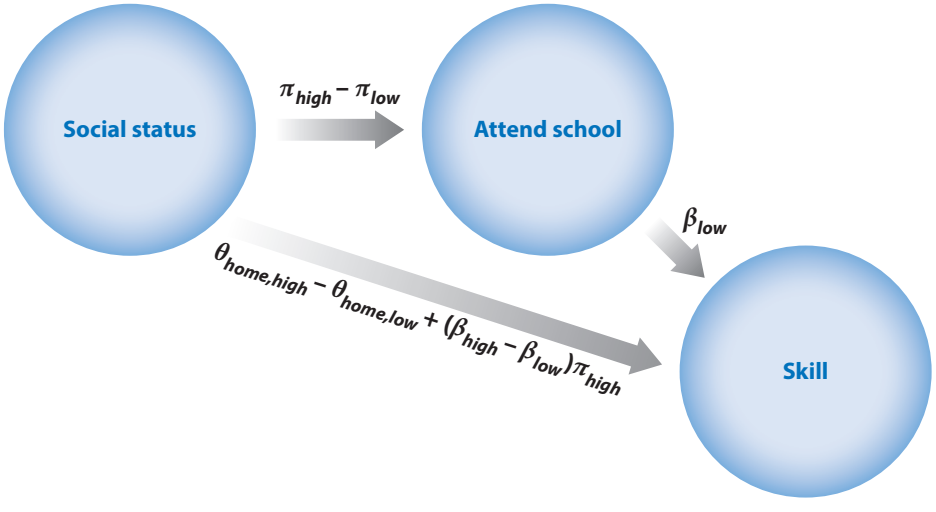

Figure 3

Modified status attainment model for schooling.

the basis of evidence that high-SES children are assigned teachers who are more experienced and knowledgeable (Clotfelter et al. 2007) within schools that are richer in resources (Raudenbush et al. 1998). Many studies (see Hanushek's 2003 review) suggest that attempts to equalize resources for high- and low-SES students produce modest effects, particularly in relation to the overall disparity, which is dominated then by the impact of unequal home environments as given by $\theta_{home,\,high} - \theta_{home,\,low}$. The conclusion, in effect, is that

$$\theta_{home,\,high} - \theta_{home,\,low} \gg (\beta_{high} - \beta_{low})\pi, \qquad 6.$$

which says that the SES disparity in home environments is by far the primary source of SES inequality in skill. This seems to imply that, by comparison, SES inequality in school quality varies little. The fact that home environments appear far more consequential than school environments has led many scholars to be skeptical about school improvement as a strategy for reducing social disparities.

However, the inclination to equate $\beta_{high} - \beta_{low}$ with school quality is not based on a causal model. Our causal model (Equation 4) leads to a very different interpretation. In particular, the fact that home environments are so important and so variable leads us to reason that school improvement is potentially especially important for reducing disparities, particularly if access to schooling is increased early and also if school quality is improved for low-SES children.

Extending the Model to the Life Course

Our model is primitive in that it considers the impact of the school versus home environment at each of several points in time, effectively holding constant all past input and all past gains in skill. When we turn to the empirical evidence, we therefore consider effectively static models for separate, single doses of schooling: expanding school for younger children, extending compulsory schooling for older children, and extending the school year and extending the school day for both younger and older children. We do not consider the dynamic relationships that would plausibly unfold if early expansions of schooling were complemented by later expansions. One can readily envision a cascade of beneficial consequences of combining interventions. For example, by enhancing child skill, early interventions might plausibly then increase children's capacity to benefit from later interventions, effectively increasing the productivity of both interventions. Effective early interventions might increase the skill of low-SES parents, thus reducing the SES gap in the quality of the home environment over the course of childhood and thereby reducing inequality; such increased effectiveness of parenting might support later school improvement. These prospects parallel aspects of dynamic complementarity theorized by Cunha & Heckman (2009). A fully dynamic model would become complex, and formulating such a model is beyond the scope of this article. However, the evidence we review suggests possibilities for synergies across the early life course that we consider briefly in our discussion.

Hypotheses

Our reading of the literature leads us to formulate four theoretical propositions from which we formulate three hypotheses about SES inequality in the impact of attending school.

Proposition 1: The expansion of universal public schooling will reduce SES inequality in access to school, tending to reduce SES inequality in skill. We know, for example, that in the absence of universal prekindergarten for 4-year-olds, high-SES children are more likely than low-SES children to attend nursery schools or center-based day care, environments that are similar in many regards to "school" (Duncan & Magnuson 2013). Hence, universal prekindergarten will reduce

SES inequality in access to school. Similarly, increasing years of compulsory schooling beyond the current legal school-leaving age tends to increase years of completed schooling for those who would otherwise drop out at the legal age, and these tend to be low-SES youth (Oreopoulos 2007). Symbolically, these expansions of schooling would reduce $\pi_{high} - \pi_{low}$, the discrepancy in the probability between high- and low-SES children gaining access to school (**Figure 3**).

Proposition 2: On average, low-SES students will experience a greater gain in instructional quality from attending school than high-SES students will. We reason that the schooling impact for any child will be greatest when the contrast between the effectiveness of the instructional regime at school and at home is greatest. Decades of research show that the effectiveness of the academic instruction parents provide at home, for example, instruction in academic English, varies enormously from family to family. To some considerable extent, this variation is associated with variation in parent use of academic language at home (Hart & Risley 1995, Huttenlocher et al. 1991), in parent teaching of reading, and in parent provision of school-related general knowledge (McLoyd 1998). Such differences, particularly in maternal education, are strongly correlated with SES, ethnicity, and race, in particular (Heath 1983).

In contrast, schools, although far from equal in their instructional resources, are much less variable than homes are. The seminal work of Coleman et al. (1966) brought this fact to light, which shocked those who believed that variation in children's academic achievement resulted primarily from variation in school resources. However, every assessment of educational attainment since 1966 has replicated this finding.

If the quality of instructional regimes varies less at school than at home, and if the quality of home instruction is strongly associated with social background, it follows that the contrast between the quality of instruction children receive at school versus at home is on average larger for low-SES children than for high-SES children. This difference in the impact of going to school on instructional quality, represented in Equation 3 by $\gamma_{low} - \gamma_{high}$, will work in favor of the proposition that schooling benefits low-SES children more than it benefits high-SES children, holding constant the child's capacity to benefit from instruction. This tendency of schools to promote equality would be particularly strong if educational policy were to reduce the correlation between student SES and school quality. The argument here does not contradict the belief that high-SES children receive better instruction in school than low-SES children do. Rather, we propose that high-SES children also receive better instruction at home than low-SES children do, and that SES inequality in instruction at home is larger than SES inequality in instruction at school.

Proposition 3: $\delta_{high} \geq \delta_{low}$: On average, high-SES students will tend to benefit more than low-SES students from a given instructional regime. We anticipate that a child's capacity to benefit from high-quality instruction will depend on that child's current skill, represented in Equation 3 by $\delta_{high} - \delta_{low}$. This is key to the idea of dynamic complementarity in Cunha & Heckman (2009). Specifically, as children's academic skills develop early in life, their capacity to benefit from future instruction expands. In essence, an optimal instructional regime for a high-skill child will be more productive than an optimal regime for a low-skill child. Ultimately, the payoff from staying in school will be greatest for those who have benefited most from earlier schooling. In the words of Heckman (2000, p. 3), "skill begets skill." It follows that if high-SES children receive more effective instruction (at home and school) early in life than low-SES children do, the foundation will be laid for high-SES children to benefit more from future instruction than low-SES children will. We shall assume that the capacity to benefit from instruction early in life is not socially structured, as stated in the next proposition.

Proposition 4: The differential benefit mentioned in Proposition 3 will be negligible early in childhood, that is, for very young children, $\delta_{high} \approx \delta_{low}$. Essentially, this proposition implies that

native differences in the capacity of high- and low-SES children to benefit from instruction are nil or small (Fryer & Levitt 2006).

Combining insights from Propositions 1–4 leads us to frame the following hypotheses.

Hypothesis 1: Expansion of universal publicly funded kindergarten or preschool will disproportionately and substantially benefit low-SES children. There are three reasons. (*a*) This expansion will equalize access to school or school-like environments (Proposition 1). (*b*) Low-SES children will experience a greater gain in instructional quality from attending school than high-SES students will (Proposition 2). (*c*) Although high-SES children will have higher skills at entry to preschool than low-SES children will, enabling them to benefit more from equally effective instruction (Proposition 2), this skill difference is small early in life, limiting the impact of any such differential benefit (Proposition 3).

Hypothesis 2: Extending the length of the school day or school year will tend to disproportionately benefit low-SES children. However, this benefit will diminish with age. We reason that low-SES children stand to gain from spending more time in school mainly because of the discrepancy between high- and low-SES children in the counterfactual: the quality of instruction provided when children are not in school, e.g., on afternoons during the school year or during the summer recess (Proposition 2). We reason that the differential benefit of increased schooling will be smaller when students are older, especially during the secondary-school years, by which time high-SES youth will have accrued higher skills and will hence benefit significantly more from instruction than low-SES students will (Propositions 3 and 4).

Hypothesis 3: Extending years of compulsory schooling will disproportionately benefit low-SES students, many of whom would otherwise not be in school (Proposition 1). However, this benefit will be proportionately small because the students who would drop out when legally able stand to gain comparatively little from additional schooling (Proposition 3).

THE EVIDENCE

To test our hypotheses, we focus on four ways in which a dose of schooling might increase skill, and ask whether the impact in each case is larger or smaller for low-SES children: (*a*) increasing access to preschool, (*b*) interrupting schooling with the summer recess, (*c*) extending the school day, and (*d*) extending years of compulsory schooling. We focus on those studies that expose students who vary in family SES to universal doses of publicly funded schooling, enabling an assessment of the differential impact of schooling.

The Differential Impact of Increased Access to Preschool

A number of prior studies provided important evidence about the impact of effects of early schooling. However, these studies were not included in our formal review because their samples were too homogeneous to estimate differential effects on the basis of SES. Among these are studies that exploit the legal cutoff age for enrollment in kindergarten to compare children who attended kindergarten with those who were slightly too young to attend kindergarten. Cahan & Cohen (1989) pioneered this method (Cahan et al. 2008), which has been replicated on a number of samples by Morrison and colleagues (Burrage et al. 2008, Morrison 2000, Morrison & Connor 2002, Skibbe et al. 2011). These studies revealed large effects of schooling on a range of literacy and math skills. By hypothesis, our model predicts that these effects would be larger for the children whose home environments are least conducive to literacy acquisition. However, data collected by Morrison and colleagues do not allow a comparison of impacts on high- and low-SES children because their samples included few disadvantaged students.

A second line of research establishes strong evidence of short- and long-term impacts of center-based child care for children who are too young to attend kindergarten. Duncan & Magnuson (2013) review such studies in detail, noting that in most cases the programs studied restricted access to low-income children. Perhaps the most famous of these is the HighScope Perry Preschool Study, in which children were randomly assigned to receive an intensive program of instruction in school-readiness skills (Schweinert et al. 1993). Exposure to the intervention produced immediate effects on children's cognitive test scores, although the effects faded during the early elementary years. The long-term results were remarkable: Children assigned to the preschool intervention had higher educational attainment, lower rates of special education placement, lower propensities to commit crime, and higher earnings as adults (Heckman et al. 2013). Many subsequent randomized studies have produced highly favorable outcomes for low-income children. Duncan & Magnuson (2013) found smaller effects of such interventions conducted more recently. These authors speculate that the counterfactual learning environment—that is, the learning environment a low-income child would experience if not assigned to the preschool center—has likely improved since early studies such as the HighScope Perry Preschool Study. Despite the importance of these studies for theory and policy, they do not enable us to test the hypothesis of differential impacts of schooling on children of various SES because these interventions targeted low-SES children.

To test differential effects of early schooling, we searched for the universal expansion of schooling for young children. We restricted our interest to studies that provided comparatively convincing evidence of a causal relationship between schooling and skill, as described in **Tables 1** and **2**. None of these studies were randomized but all were based on the exogenous introduction of schooling, and the overall level of statistical sophistication was reasonably high.

When multiple authors studied the same sample, we combined the results, with the consequence that our synthesis is based on 15 large samples from eight countries. Of these samples, 9 involve the expansion of prekindergarten or kindergarten (**Table 1**) and 6 involve government provision of universal child care for children under the age of 4 (**Table 2**). Studies varied in the kinds of skills assessed: Cognitive test scores were the most common ($n = 9$); other outcomes included social behavior or self-control ($n = 4$), grades ($n = 3$), attained schooling ($n = 4$), motor skills ($n = 1$), and labor-market outcomes ($n = 1$). Recall that we had hypothesized that expansion of universal publicly funded kindergarten, prekindergarten, or preschool would disproportionately and substantially benefit low-SES children and that these effects would be comparatively large (relative to the effects of later interventions).

The results were quite convergent. For 13 of the 15 samples, the investigators provide evidence that low-SES children benefited more from early schooling than higher-SES children did. A caveat to this finding is that authors rarely tested the significance of the difference between the impacts for higher- and lower-status children. We more commonly see separate point estimates and/or separate *p*-values for the two groups. Of course, knowing that point estimates were higher for low-SES students than for high-SES students or that *p*-values were below a threshold for low-SES but not high-SES children does not imply that effects were differential. However, the near uniformity of the direction of the effects (that is, larger effects for low-SES children), the size of differences, and the fact that nearly all the samples were very large suggest an unmistakable tendency for low-SES children to benefit more from the expansion of universal schooling at early ages. The evidence in favor of differential impacts was quite robust across outcomes and across the eight countries studied. The main exception was the introduction of universal child care in Quebec, Canada. In this case, evidence appeared to suggest negative effects of center care on social behavior, mental health, motor skills, and parent-child relationships. The impacts appeared more negative for low-SES parents than for high-SES parents. No differential effects by SES were reported for one sample that included immigrant children from two districts in Norway. Space

Table 1 Early education

Reference(s)	Sample	Treatment	Identification strategy	Outcomes
Berlinski et al. 2008	Uruguayan Encuesta Continua de Hogares for 2001–2005; sample of children ages 7–15 ($n = 23{,}042$)	Universal preschool for 4- and 5-year-olds	Sibling fixed effects	Children with low-educated parents are 27 percentage points more likely to be in school at age 15; no significant effects for children of highly educated mothers
Berlinski et al. 2009	Administrative data from the Argentine National Education Ministry on third through seventh graders from 1994 to 2000	Universal early education program for students ages 3–5	DID	Point estimates in Spanish and math larger for poor students than for nonpoor students
Cascio & Schanzenbach 2013	October CPS School Enrollment Supplements; data on nationwide pre-K enrollment from 1968	Universal pre-K access in Oklahoma and Georgia	DID	Poor children show increases in math scores up to eighth grade; no significant impacts on math achievement for nonpoor children Greater increase in enrollment for poor children; decrease in private pre-K enrollment for nonpoor children only
Cascio 2009, Cascio & Schanzenbach 2013, Dhuey 2011	US census data from 1970 to 2007, linked to state policy data	Universal kindergarten for 5-year-olds	DID	Lowest-income children less likely to be behind in grade (suggests lower repetition rates) No impact for higher quartiles No positive impact on earnings Lower institutionalization and dropout rates for White students only
Gupta & Simonsen 2010; ND Gupta & M Simonsen, unpublished manuscript	Survey of primary parents of Danish children born in 1993–1996 ($n = 6{,}000$); data points from 6 months to high school completion in 2013–2014	Universal day care	IV comparing districts that offered more center care versus family care locations	Positive effects of attending center care versus family care on child behavior for boys with mothers who have low education Enrollment in day care at age 2 significantly increases ninth-grade GPA by two standard deviations
Drange & Telle 2010	All 5-year-old children from immigrant families in Oslo, Norway, who were born in 1992 and 1993	Free universal preschool	DID exploiting implementation in just two districts in Oslo	No report of differential effect on GPA by SES; however, girls but not boys benefited
Fitzpatrick 2008	National Assessment of Education Progress test scores for US children for the years 1994, 1996, 1998, 2000, 2002, 2003, and 2005	Access to universal pre-K	DID	Positive impacts for Black student test scores and likelihood to be on-grade, and for White student test scores in rural and urban fringe areas
Gormley & Gayer 2005, Gormley et al. 2005	Children ages 4–5 in Tulsa, Oklahoma ($n = 3{,}727$)	Universal access to schooling for 4-year-old children	RDD by age	For language, knowledge, and applied math problems, larger point estimates for low-income children and smaller point estimates effects for others Positive effects for all children in spelling and letter-word correspondence

(*Continued*)

Table 1 (*Continued*)

Reference(s)	Sample	Treatment	Identification strategy	Outcomes
Leuven et al. 2010	Dutch primary students, years 1994–2003 (n = 5,000)	Universal to early elementary	Exploits timing of birth and delay of school entrance due to summer recess	One-month increase in exposure increases language and math scores for disadvantaged students; no significant impact on advantaged students
Weiland & Yoshikawa 2013	Children ages 4–5 in Boston (n = 2,018)	Universal access to schooling for 4-year-old children	RDD by age	Effects on receptive vocabulary, early reading, numeracy, working memory, and inhibitory control; all point estimates larger for low-income children than for other children

Abbreviations: DID, difference in differences; IV, instrumental variable; RDD, regression-discontinuity design.

prohibits a detailed presentation of all 16 studies. However, a sketch of 4 of the studies may help portray the kind of work considered here.

Gormley and colleagues (Gormley & Gayer 2005, Gormley et al. 2005) assessed the impact of expanding access to preschool for 4-year-olds in Oklahoma. Prior to 2000, universal kindergarten was available to 5-year-olds. When the government extended access to 4-year-olds, the investigators exploited the legal age cutoff using the regression-discontinuity method, providing a reasonably strong basis for causal inference. Low-income children experienced substantial gains in language skills, applied problem solving in math, and general knowledge—gains not experienced by higher-income children. Developmental scientists have found these skills important for the later emergence of reading comprehension, writing, and mathematical reasoning (Levine et al. 2011). All students gained knowledge in spelling and letter-sound correspondence—there was no differential impact by SES for these two outcomes. Nearly all students will obtain these skills if provided reasonable instruction in kindergarten and first grade, so we find this result of no differential impact of less significance than the differential impact in higher-order thinking skills.

Weiland & Yoshikawa (2013) obtained broadly similar findings when using the age-cutoff method to assess the impact of universal prekindergarten attendance on their sample of Boston children. On average, 4-year-olds attending preschool gained more on receptive vocabulary, early reading, numeracy, working memory, and inhibitory control than those who did not attend preschool. Low-income students gained significantly more on numeracy, inhibitory control, and attention than higher-income students did.

So there is evidence that expanding schooling to include prekindergarten children significantly reduces inequality in important cognitive skills (though the data currently available cannot tell us whether such impacts will be sustained). What about the earlier but much larger expansion of access to kindergarten? According to Dhuey (2011), Ohio was the first US state to provide kindergarten to all, a policy enacted in 1935. By 1986, when the state of Mississippi made the same policy shift, all US states provided universal kindergarten (generally for 5-year-olds). Using data from the decennial census, Dhuey (2011) exploited variation in the timing of kindergarten expansion to assess its impact on several outcomes. She found that exposure to kindergarten significantly reduced the probability that children from low-income families would later be behind in grade. Given that many studies have found grade retention to be a powerful predictor of dropping out of high school (Rumberger 2011), this finding is intriguing. However Dhuey (2011) found no positive impacts on completed schooling or labor-market outcomes. This research method based

Table 2 Day care

Reference(s)	Sample	Treatment	Identification strategy	Outcomes
Baker et al. 2008; Lefebvre et al. 2008	National Longitudinal Survey of Children and Youth; children between 0 and 11 (n = 22,000); 5-year-olds excluded to isolate effects of child care from those of kindergarten	Quebec Family Policy offering subsidized universal child care	DID	Universal care increased anxiety, aggressiveness, and illness and had a negative impact on motor and social skills, parental health, and parental relationship quality More negative effects for mothers with low education
Dustmann et al. 2012	Administrative data on school readiness for all children ages 3–6 in a West German region between 1994 and 1996; including native (n = 78,000) and immigrant (n = 10,000) children	Universal child care program for children ages 3–6	DID with IV	Time in child care reduces language and motor skill problems and improves school readiness for immigrant children, but not native German children
Felfe & Lalive 2013	German Socio-Economic Panel; children 2–3 years old, born between 2002 and 2008 in West Germany (n = 870)	Universal child care with 1995 day care expansion law	DID with IV	Increased effects of child care on school readiness, language, and motor and social skills for children who are low income, low birth weight; children with foreign parents; and children whose mothers have low education
Felfe et al. 2013	Norway Program for International Student Assessment; 3-year-olds born in 1987, 1990, and 1993	Expansion of subsidized child care for 3-year-olds in 1991	DID	Improved reading test scores by 0.13 SD at age 15 for students whose parents had low education, decreased primary school retention by 59% No significant effects for children with high-skilled parents
Havnes & Mogstad 2011, 2015	Statistics Norway administrative registers of the entire population between 1996 and 2006; sample includes children ages 3–6, or 87% of each cohort (n = 499,026)	Universal subsidized child care	DID	Increased effects on children's educational attainment and labor-market participation, reduced welfare dependency for females and children with low-educated mothers Positive effect on earnings for low-income children only

Abbreviations: DID, difference in differences; IV, instrumental variable; SD, standard deviation.

on census data was unable to test impacts on skills; moreover, the assumptions required for causal inference are stronger here than in the regression-discontinuity designs just described, so we have somewhat less confidence in the findings. An earlier study by Cascio (2009) had found favorable impacts on completed schooling and mental health for Whites but not Blacks, providing perhaps a caveat to our overall finding, though we do not know about differential impacts by SES in this sample.

One additional study bears discussion. Rather than studying a policy that expanded schooling for all, Leuven et al. (2010) exploited an unusual feature of the Dutch educational system to estimate the causal impact of exposure to early schooling. In the Netherlands, primary-school children who are born just prior to the date of the summer recess experience 11 fewer weeks of

schooling than do classmates who were born just after the date of the end of summer recess. This finding allowed the investigators to implement an instrumental variable analysis based on birth date and the timing of the summer recess, enabling them to discover that one month of increased exposure to school increased language and math scores for disadvantaged students; no impact was found for advantaged children.

In sum, on the basis of 15 large-scale studies of the introduction of early universal schooling across eight nations, the preponderance of evidence strongly favors the hypothesis of differential effects: Low-SES children tended to benefit more than high-SES children across a range of outcomes in varied societies. How do we explain this finding? Our model predicts differential effects of expanded schooling if (*a*) expansion differentially increases access to school and/or (*b*) low-SES children benefit more from access than high-SES children do. It is difficult to distinguish these contributions on the basis of the cases we have examined. There is good evidence that high-SES parents are substantially more likely to send their children to a private school (or a school-like environment such as center-based care or part-time nursery school) when universal prekindergarten schooling is not available (Cascio & Schanzenbach 2013, Duncan & Magnuson 2013). Hence, it can be argued that the provision of universal preschool equalizes access to school for young children. There is also considerable evidence, reviewed above, that high-SES parents are especially likely to provide instructional environments at home that favor academic learning. It seems highly plausible that, in the absence of universal free schooling, high-SES parents can provide an array of educative environments, whether at home or in a school setting, that tend not to be available to low-SES parents.

The Differential Impact of School Attendance in the Elementary Years

Striking evidence of the impact of attending elementary school comes from a series of studies that test children in the fall, near the beginning of school year, and in the spring, at the end of the school year. Heyns (1978) was apparently the first researcher to exploit this design, which allows us to compare children's learning rates during the summer and the academic year. Growth rates are dramatically higher during the school year than during the summer, especially in math, for which summer growth rates are effectively nil. In reading, children do make gains during the summer, not surprisingly, because they encounter text at home from a variety of sources. However, growth rates in reading comprehension are far greater during the academic year than during the summer.

Bryk & Raudenbush (1988) formulated a three-level hierarchical linear model to study academic-year versus summer growth. This approach purges measurement error from estimates of the growth rates. This enabled them to define "schooling effect" as the discrepancy between the rate of a child's growth during the academic year and that child's rate of growth during the summer. Schooling effects so defined were very large. But do these effects vary by SES?

To answer this question, we reviewed two kinds of studies. First, several studies have compared students' learning rates during the school year with those during the summer when school is not in session. In these studies the impact of school attendance is the within-student difference between academic-year and summer learning rates. The second kind of study evaluates the impact of extending instruction into the summer. Here the impact of school attendance is the difference between gains made by students who experienced the extended school year and gains made by similar students who experienced instead the usual school recess.

Alexander et al. (2001, 2007a,b) assessed their Baltimore sample of 790 students during the fall and spring of five elementary school years. Using a hierarchical linear model, they compared academic-year and summer learning rates for each year. They found summer learning rates in reading and math to be significantly greater for high-SES than for low-SES children. In contrast,

academic-year learning rates varied much less by SES. These results provide evidence that low-SES children gained more from schooling than high-SES children did. Indeed, the authors found that SES differences in summer learning rates accounted for a substantial fraction of overall SES inequality in reading and math skills during the primary years. Moreover, this degree of inequality becomes statistically important in predicting SES inequality in assignment to a college-bound curriculum in high school.

One might reasonably ask whether results from the comparatively small Baltimore sample generalized to a broader population. Downey et al. (2004) essentially replicated the Baltimore findings for first- and second-grade children using the nationally representative Early Childhood Longitudinal Study of 1998. Again using a hierarchical linear model, they found that attending school (versus not attending school during the summer) accelerated and equalized learning as a function of SES; that is, child-specific school effects defined as comparisons between academic-year and summer learning rates were greater for low-SES children than for high-SES children during kindergarten and first grade.

Although supporting the hypothesis that schooling reduces social inequality, studies of academic-year and summer learning have limited implications for public policy because they do not tell us whether an attempt to extend the school year would disproportionately benefit low-SES children. However, two well-designed studies suggest that extending schooling into the summer can in fact boost outcomes. Jacob & Lefgren (2004) studied a large sample of students from Chicago who had experienced difficulty during the academic year. Those scoring below a cutoff point on the spring test were assigned to summer school. Attendance at summer school significantly increased test scores, providing evidence that students can significantly benefit from summer instruction. However, the Chicago sample was not sufficiently diverse to test differential effects by SES. Allington et al. (2010) conducted a randomized trial showing that a much weaker summer intervention (see **Table 3**) not only produced positive impacts on test scores but also benefited low-income students more than high-income students.

In sum, research on summer versus academic-year learning not only vividly displays the large impact of school attendance on learning but also supports the hypothesis that low-SES students benefit more from school than high-SES students do. This finding raises important questions about what low- and high-SES children do while school is out of session. Lareau (2011) provides an intriguing explanation in her in-depth qualitative case study of low- and high-SES families. The high-SES families tend to engage their school-age children in a range of educative experiences (e.g., music, athletics, and academics) outside of school, experiences she characterizes as concerted cultivation, whereas the low-SES families allow their school-age children considerable leeway in how time is spent when not in school.

Recall our hypothesis that the tendency for low-SES children to gain more from schooling than high-SES children do would be large early in life but would diminish with age. An important finding regarding summer versus academic-year growth rates is that the equalizing effect of school attendance is sustained through the elementary years. Gamoran (1996) cites research suggesting that by the time students reach high school, SES gaps in learning rates during the school year become quite large. This implies that the tendency for low-SES children to gain more from schooling than high-SES children do may cease when students make the transition to high school. We return to this question in the conclusion.

The Differential Impact of Extending the School Day

A third way to expand exposure to schooling is to extend the school day. Do low-SES children benefit more from such an expansion? Here the results are mixed (see **Table 4**).

Table 3 Extended year

Reference(s)	Sample	Treatment	Identification strategy	Outcomes
Alexander et al. 2001, 2007a, 2007b	Beginning school study in Baltimore, MD; students who began first grade in fall of 1982 ($n = 790$)	School-year learning versus summer learning	Compare academic year to summer growth	Growth rates for high-SES but not low-SES students increase during summer; similar growth during academic year
Allington et al. 2010	Students ages 9–14 ($n =$ 1,669 treatment, $n = 939$ control) over 3 years	Treatment group receives self-selected trade books during three summers	Randomized controlled experiment	Test score improvement effect size was 0.14 overall, 0.21 for low-income students
Downey et al. 2004	Early Childhood Longitudinal Study 1998–1999	School-year learning versus summer learning	Hierarchical linear model with random coefficients	Schools accelerate and equalize learning
Kim 2006	Final sample included 486 students ($n = 252$ treatment, $n = 234$ in the control)	Treatment group given eight books to read over the summer and encouragement to read by teachers	Randomized field trial	Largest point estimates on reading scores for Black and Latino students (ES = 0.22 and 0.14, respectively), less fluent readers (ES = 0.17), and those with fewer than 50 books at home (ES = 0.13)
Parinduri 2013	RAND Corporation's Indonesia Family Life Survey ($n > 30{,}000$)	Arbitrary assignment to longer school year in 1978–1979	RDD and IV	Increased effect on rural students in grade repetition and educational attainment Significant decrease in grade repetition for females only

Abbreviations: ES, effect size; IV, instrumental variable; RDD, regression-discontinuity design.

Gibbs (2010) conducted a large-scale study in which children were assigned at random to attend either full-day or half-day kindergarten within each of the five Indiana school districts. The primary aim was to discover impacts on literacy skills. Low-SES children gained substantially and significantly more in reading from attending full-day kindergarten compared with their middle- or high-SES counterparts. Indeed, for high-SES children, Gibbs could not reject the null hypothesis of no benefit.

Using a regression-discontinuity design, Gibbs also assessed the impact of full-day versus half-day kindergarten in other Indiana districts. In these districts, assignment to full-day kindergarten was restricted to students whose parents' income fell below a cutoff point. Gibbs found no impact of full-day kindergarten on these students. It is interesting to speculate on the explanation for the difference between the results of the randomized trial and the regression-discontinuity study. The regression-discontinuity design entails a means-tested intervention in which eligible low-income students were assigned either to attend full-day kindergarten with other low-income students or to attend half-day kindergarten with higher-income students. If the low-income children were assigned less-qualified teachers or experienced less-favorable learning environments on the basis of peer behavior, these effects would tend to mask any favorable impact of full-day kindergarten. In contrast, the randomized trial was a universal intervention in the sense that being assigned to full-day kindergarten had no impact, on average, on one's peers.

Table 4 Extended day

Reference(s)	Sample	Treatment	Identification strategy	Outcomes
Bellei 2009	95% of Chilean tenth graders tested in 2001 and 2003	Increased high school instruction time by 27%	DID	Positive effect on math and language achievement, more effect in rural than urban settings, more in public than voucher schools
Black et al. 2009	Students in second through fifth grades who are behind grade level in reading or math (27 schools)	Formal instruction 3 h/week	Random assignment within school by grade cells	Impact on math is 3.5 scaled points. One year has same benefit as 2 years; negative (significant) impact of being in the reading program for 2 years
Gibbs 2010	Five school districts in Indiana in 2007–2008. Full-day students (n = 661) and half-day students (n = 423)	Time in school: full-day versus half-day kindergarten students	Random assignment	Point estimates for effect of full day higher for low-income students, non-White children, and students with low literacy scores
James-Burdumy et al. 2008	1,000 elementary school students	After-school program	Random assignment	Negative effects of program on behavior for boys with history of disciplinary problems
Kraft 2015	Lottery and Massachusetts public school data for sophomore cohorts of 2002–2009 (n = 2,635)	Lengthening of school day	DID and IV	Increased effects in math and English for students in the lowest achievement quintile
Lauer et al. 2006	35 out-of-school-time programs employing control or comparison groups	Out-of-school-time program	Meta-analysis	Significant effects for reading and math scores, larger effect sizes for programs with reading tutoring; all disadvantaged sample, no differential effects
Orkin 2013	School-age children (n = 1,794) over 10 years in Ethiopia	Lengthening of school day from 4 to 6 hours	DID	Improved writing and math scores for 8-year-olds, no significant effect on reading Larger effects for girls and better-off children, i.e., those who were not stunted, were from richer households, or were in urban schools

Abbreviations: DID, difference in differences; IV, instrumental variable.

In contrast to the results of Gibbs's randomized trial of full-day kindergarten, experimental evidence of the impact of expanding the school day in later elementary school years is less inspiring. One large-scale randomized trial (James-Burdumy et al. 2008) found no evidence of gain from attending extended-day instruction during the elementary and middle school years and some evidence of a negative impact on behavior. One question that arises from this study is whether the instruction provided in the after-school program was high in quality and coordinated well with the instruction supplied during the regular school day. Black et al. (2009) conducted a randomized trial in which the after-school program targeted students with low skills in math, producing significant positive effects. There was no differential impact by socioeconomic background, but Black students benefited more than White students did. However, the impact of the program on reading appeared to be negative overall.

Finally, we note that Bellei (2009) conducted a very different kind of study, assessing the impact of a nationwide policy shift that substantially increased instructional time in Chile. Effects on math and language achievement were significantly positive; rural students, who tend to be more disadvantaged than urban students, benefited more.

In sum, there is mixed evidence about the impact of extending the school day. There is mixed evidence that low-SES students benefit more, and indeed there is mixed evidence regarding the impact overall. The strongest evidence in favor of the differential impact hypothesis comes from Gibbs's (2010) randomized trial of full-day kindergarten, which provides evidence of differential impact, such that low-SES students gain significantly and substantially more in literacy compared with other students.

The Impact of Extending Compulsory Schooling on Disparities

Over the past century, all societies have expanded access to school, in part by making schooling compulsory for all youth below a given age. Periodically, governments have increased the age at which it is legal to leave school. Researchers have exploited these changes in policy to estimate the causal effect of universal schooling on labor-market outcomes. We summarize findings from studies in 13 societies in **Table 5**. These studies invariably report positive effects on earnings for cohorts of students exposed to the new policy. The gains arise because some students who would have dropped out of school at a given age under the old policy stay in school under the new policy. Many of those who stay on successfully complete at least one additional year of schooling, adding on average about 10% to adult earnings. Those induced to stay on by the new policy are in every instance lower in SES, on average, than those who would have stayed in school beyond the legal age under the old policy. For that reason, extending compulsory schooling disproportionately benefits low-SES students with a corresponding reduction in SES earnings inequality.

Extending compulsory schooling reduces SES inequality in earnings by increasing the attained schooling of some low-SES students. However, it is not the case that low-SES adolescents benefit more from a year of schooling than high-SES adolescents do. It is quite well established in the studies in **Table 5** that (*a*) by the adolescent years, cognitive skills are moderately positively associated with SES in every society studied to date, and (*b*) high-skill students benefit more in the labor market from additional years of schooling than low-skill students do.

Indeed, there is evidence that extending the school-leaving age has a limited impact on the most disadvantaged students. For example, a fairly substantial number of highly disadvantaged students in the United States who were compelled to stay in school by new legislation increasing the legal school-leaving age did not increase their attained schooling (Murnane 2013, Oreopoulos 2007), presumably because these students failed too many courses. This finding illustrates the limited extent to which schooling ceases to reduce SES inequality at later ages.

In sum, although extending compulsory schooling reduces SES inequality, the impact of such a gap-reduction strategy is, under our model, constrained by the extent to which low-SES children experience comparatively ineffective instruction at home and in school prior to and during adolescence. These experiences presumably reduce adolescents' capacity to benefit from expanded access to schooling.

CONCLUSION

When governments do not provide universal access to schooling, high-SES children and youth are more likely than their low-SES counterparts to attend school. Reforms that ensure universal access to school will reduce SES inequality in skill so long as children receive better instruction when in

Table 5 Compulsory schooling

Reference(s)	Sample	Treatment	Identification strategy	Outcomes
Oreopoulos 2007	US 1901–1961 birth cohorts, ages 25–64 in the 1950–2000 census; Canada 1911–1961 birth cohorts, ages 25–64 in 1971–2001 census; UK 1921–1951 birth cohorts, ages 32–64 in 1983–1998 GHHS	Changes in compulsory schooling laws	DID	Lifetime wealth increases by 15% with an extra year of compulsory schooling Adults with more compulsory schooling have increased lifetime spending, increased satisfaction, better health, better opportunities for employment, and less depression
Oreopoulos et al. 2006	Sample of children ages 7–15 from 1960, 1970, 1980 US censuses	Influence of parental compulsory schooling on children's grade for age	Natural experiment, IV, causal effect of education on next generation's well-being	One year in parental education reduces the probability of retention by 2–4 percentage points Schooling effect greater for those with the least skills
Oreopoulos 2006	United Kingdom; British-born adults ages 32–64 from 1983 to 1998	Change in minimum school-leaving age from 14 to 15 in 1947	RDD in age	Earnings increased by 10–14% annual gain effects from compulsory schooling; higher for disadvantaged children
Brunello et al. 2009	12 European countries, 1962–2004	Years of schooling	DID	Wage differential between the 90th and 10th percentiles reduced by approximately 1% for men and 1.34% for women Education returns greatest for men in the bottom decile of earnings
Aakvik et al. 2010, Brinch & Galloway 2012	Norwegians born 1947–1958	Compulsory education increased for 7–9 years between 1960 and 1972	Natural experiment, reform as IV	9.4% return to education for those who would have stopped attending school without policy change Association between family SES and attainment reduced; 0.6 point increase in IQ score
Meghir & Palme 2005	Malmö, Swedish children born in 1948 and 1953	Increased compulsory schooling from 7–8 to 9 years, end tracking imposed national curriculum	DID	Overall earnings increase 1.42%, but 3.4% for children with unskilled fathers Children with skilled fathers experience a 5.6% decrease in earnings postreform. However, return to education is 12.8% for high-ability individuals and only 5.6% for low-ability individuals

Abbreviations: DID, difference in differences; GHHS, General Household Survey; IV, instrumental variable; RDD, regression-discontinuity design.

school than when not in school. Evidence from many studies of universal kindergarten, universal prekindergarten, and compulsory schooling, reviewed here, strongly supports this conclusion.

But suppose now that high- and low-SES children have equal access to school. Does attending school increase or reduce social inequality in skills? According to our model, the contrast between home and school instructional environments is larger for low-SES children than for high-SES children. Although high-SES children receive better instruction at school than low-SES children do, instructional quality at home is even more unequal. Symbolically, $Q(1) - Q(0)$, the difference between instructional quality at school and at home is larger for low-SES children than for high-SES children. This contrast tends to make schooling an equalizing force in society.

However, we reason that a child's capacity to benefit from instruction depends on the current skill of that child. More technically, the optimal instructional regime for a high-skill student will be more productive than the optimal instructional regime for a low-skill student. Because high-SES children receive better instruction at home and at school than low-SES children do, they will tend to gain skill at a faster rate. As they grow older, these gains in skill will in turn enable them to benefit more from instruction. This contrast in the accumulating capacity to benefit from instruction tends to make schooling a disequalizing force in society.

We reasoned that SES differences in skill are small early in life, so that schooling at early ages should be equalizing. However, as children grow older, skills tend to diverge and high-SES students tend to benefit more from schooling.

To test these ideas, we reviewed evidence on the impact of four doses of schooling: attending preschool, staying at home in the summer, experiencing longer school days, and increasing the years of compulsory schooling. The results were broadly consistent with the hypotheses generated by the model.

First, the introduction of universal prekindergarten and universal day care produced larger benefits for low-SES than for high-SES children across a wide range of societies and with respect to a fairly wide range of skills. These were equalizing reforms. Some of the equalization can be attributed to the fact that high-SES children are more likely to attend nursery schools or formal day care centers when universal preschool is not available. So the reform equalizes access to something like "school," and the studies we review cannot separate this effect of equalized access from the tendency of low-SES children to benefit more from attending school.

Second, studies that compare learning rates while children are in school with learning rates when not in school (typically during the summer) reveal the equalizing impact of school attendance. This is important because the equalizing impact of schooling persists through the elementary years and because the impact of school attendance is isolated from the impact of equalized access.

Third, there is good reason to believe that in high school and beyond the tendency of school attendance to reduce SES inequality diminishes to zero and is reversed. The research cited here suggests that learning rates of high- and low-SES students tend to diverge during the high school years, and there is little doubt that high-skill adolescents tend to gain more in the labor market from staying in school than low-skill adolescents do. Because skill and SES are quite positively correlated by this age, we can infer that high-SES students, on average, gain more from additional schooling during adolescence than low-SES students do. Nevertheless, extending universal schooling by increasing the school-leaving age reduces SES inequality in labor-market outcomes because it equalizes access to school.

We noted that our model suggests that the average impact of schooling is maximized when those who stand to gain the most from instruction experience the greatest gains in instructional quality by attending school. We have no information on whether the correlation between such "capacity to gain" and the "enhancement of opportunity" differs between high- and low-SES children. However, this correlation likely gets stronger as children grow older. Youth with high

levels of skill and hence high capacity to gain from further instruction appear to have enhanced instructional opportunities in secondary and postsecondary school. This increasing correlation would tend to accelerate the tendency for schooling to increase inequality during adolescence.

Dynamic complementarity (Cunha & Heckman 2009) enables early investments in skill to enhance the effectiveness of later investments. We can see how this would play out under our model as children do or do not receive each dose of schooling. Thus, disadvantaged students who hypothetically benefited substantially from preschool followed by full-day kindergarten would nonetheless lose ground if they were to experience a long summer recess. However, if such children were to experience better instruction during the summer during each year of elementary and middle school, we would expect a large benefit to skill, thus increasing the capacity of such students to benefit from secondary schooling. The cumulative effect of such a sequence of decisions on social inequality in skill may be substantial. In contrast, a low-SES child denied access to preschool at age 4 who then attended a half day of kindergarten and then experienced long summer recesses would, under our model, suffer the cumulative burden of inadequate instruction, not only reducing current skill but also reducing the benefit of future schooling.

The trajectories just imagined are of course the product of theory invoked to give life-course coherence to what are in our review a collection of studies of specific doses of schooling experienced by different subsets. Nonetheless, such theoretical visions may inspire useful new research and encourage researchers and policy makers to take a life-course view.

Perhaps the central irony of this exercise is that it enables us to reason that schooling can be a powerful equalizing force, particularly early in life, even though disadvantaged students receive instruction in school that is inferior to the instruction received by advantaged students (Raudenbush 2008). Schools in this setting are equalizing only because instructional regimes at home are presumably far more unequal than instructional regimes at school. There is thus good reason to speculate that concerted attempts to supply disadvantaged students with carefully designed instruction, experienced, knowledgeable teachers, and effective school organizations would amplify the capacity of schools to play an equalizing role in society.

APPENDIX: ASSUMPTIONS FOR A CAUSAL MODEL OF SCHOOL IMPACT

A child receives an extra dose of schooling ($S = 1$) or not ($S = 0$) and, as a result, experiences the quality of instruction $Q(1)$ if $S = 1$ or $Q(0)$ if $S = 0$. The impact of going to school on instructional quality for that child is $\Gamma = Q(1) - Q(0)$. This specification requires the following:

A1: Stable Unit-Treatment Value Assumption (SUTVA): The potential outcome of receiving the extra dose does not depend on the manner in which the treatment is implemented (e.g., by requiring school or by choosing school) nor does it depend on school assignments of other participants. (In this article we consider only exogenous school assignments so we do not need to worry about choosing to go to school.)

The impact of receiving an extra dose of schooling for a particular child is $\mathrm{B} = Y(S = 1) - Y(S = 0) \equiv Y(1) - Y(0)$. However, the impact works only through the change in instructional quality. Hence, $\mathrm{B} = Y(Q(1)) - Y(Q(0))$. Here we are assuming

A2: Exclusion restriction: $Y(s) \equiv Y(s, Q(s)) = Y(Q(s))$ for $s \in \{0, 1\}$.

The child-specific impact of an increment to instructional quality on a particular skill is Δ. Here we are assuming

A3: Linearity of impact of instruction: $Y(Q(s)) = Y(Q = 0) + \Delta Q(s)$ for $s \in \{0, 1\}$. Here $Q = 0$ represents "no instruction."

Under these assumptions, the impact of receiving a dose of schooling is $\mathrm{B} = \Delta\Gamma$.

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