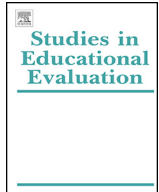




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School characteristics moderating the relation between student socio-economic status and mathematics achievement in grade 8. Evidence from 50 countries in TIMSS 2011

Jan-Eric Gustafsson^{a,b,*}, Trude Nilsen^c, Kajsa Yang Hansen^a

^a University of Gothenburg, Department of Education and Special Education, P.O. Box 300, S-40530 Gothenburg, Sweden

^b University of Oslo, CEMO, Postboks 1161, Blindern, Oslo 0318, Norway

^c University of Oslo, Department of Teacher Education and School Research, P.O. Box 1099, Blindern, 0317 Oslo, Norway

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ABSTRACT

The main aim of the study was to identify school characteristics that can reduce the relation between socio-economic status (SES) and achievement, so that equity of educational outcomes can be improved. Data from 50 countries participating in the Trends in International Mathematics and Science Study (TIMSS) conducted in 2011, focusing on Grade 8 mathematics, was analysed. Two-level random slopes models fitted at school- and student-levels were used to investigate the influence of quality and quantity of instruction, school climate, and school SES on the within-school regression slope for achievement on SES. The results showed school SES to be the strongest determinant of slope differences across schools and educational systems. Whether school SES relates negatively or positively to the within-school regression of achievement on student SES is an indicator of whether the educational system is compensatory or anti-compensatory with respect to student SES.

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1. Introduction

Socio-economic status (SES) refers to an individual's or a family's position in a hierarchy according to access to wealth, power, and social status. The correlation between students' academic achievement and family SES is in most countries around 0.20–0.40 at the individual level (Sirin, 2005) and with data aggregated to the class or school levels it is considerably higher. In order to increase educational equity, the strength of these relations needs to be reduced. However, little is known about which school factors influence the relationship between SES and educational achievement. One reason for this may be that little attention has been devoted to investigating the mechanism through which SES is related to educational achievement. Instead researchers have taken advantage of SES to control for selection bias in investigations of effects of school factors and instructional variables, thus focusing on main effects of SES. However, if the aim is to influence the strength of the relationship between SES and

educational achievement, school characteristics that reduce the relation between SES and achievement need to be identified.

One challenge when investigating effects of school factors in observational studies is that the amount of variation in the investigated factors often is restricted within any particular country. However, taking advantage of international comparative large-scale data may increase the possibility of identifying factors influencing the strength of the relationship between SES and achievement. The current study is based on data from 50 countries participating in the Trends in International Mathematics and Science Study (TIMSS) conducted in 2011, focussing on outcomes in the area of mathematics. We use these data to investigate the influence of quality and quantity of instruction, school climate, and school SES on the relation between SES and achievement.

1.1. Conceptualization of SES

A large body of empirical evidence has established student family SES as being one of the most powerful predictors of school outcomes (e.g., Sirin, 2005; White, 1982). However, there is little consensus on precisely what SES represents (e.g., Liberatos, Link, & Kelsey, 1987; McLoyd, 1998), and there is great variation in the relationship between SES and educational achievement across different studies. Sirin (2005) concluded that the variation in the

* Corresponding author at: University of Gothenburg, Department of Education and Special Education, P.O. Box 300, S-40530 Gothenburg, Sweden.

E-mail addresses: Jan-Eric.Gustafsson@ped.gu.se (J.-E. Gustafsson), trude.nilsen@ils.uio.no (T. Nilsen), kajsa.yang-hansen@ped.gu.se (K.Y. Hansen).

strength of the SES effect may partially be accounted for by how SES is being measured. Family SES is typically measured by parental education level, occupation and income but other indicators, such as eligibility for free lunch, or material possessions, number of siblings, family structure and ethnicity are also used. Most often, SES is measured as a composite of different indicators, reflecting the view that SES may be regarded as a combination of different types of capital or resources that influence children's development (Coleman, 1988, Bourdieu, 1986). It has been argued that measuring SES as a unidimensional construct may neglect some of the important aspects of SES (e.g., Yang & Gustafsson, 2004; Yang, 2003). Using Programme for International Student Assessment (PISA) 2000 data, Marks, Cresswell and Ainley (2006) found that family cultural resources played a more important role than family material resources, and that cultural resources, such as number of books in the home, explained a substantial amount of socioeconomic inequality in academic achievement in most of the countries. To explain differences in educational achievement, the best approach to measure student SES thus is to use a relatively broad measure of home educational resources that captures aspects such as number of books at home, parental level of education and amount of study support at home. Such scales have been constructed, for example, for TIMSS (Martin, Mullis, Foy, & Arora, 2012) and for PISA (OECD, 2012).

1.2. The relations between SES and educational achievement

While a pervasive influence of SES on achievement has been demonstrated in numerous studies, explanatory models which account for the mechanisms through which the influence occurs are not so well developed. Within educational research, there are basically two ways in which such factors can cause SES to be more or less strongly related to educational achievement. First, educational factors may have differential effects on low- and high-SES students. For example, if instructional quality has a stronger positive effect on the achievement of low-SES than high-SES students, there is a differential or interactive effect. Another way to phrase this is to say that instructional quality moderates the relation between SES and achievement. The second way that educational factors may influence the observed relationship between SES and achievement is through a correlation between SES and educational factors. For example, if low-SES students tend to be provided with instruction of lower quality than high-SES students, this will cause their level of achievement to be lower. The effect will be a function both of the amount of difference in level of quality of instruction between the SES-groups, and of the extent to which quality of instruction is related to achievement. These are additive effects of SES and instructional quality, and we conceive of instructional quality as a factor which mediates the effect of SES on achievement.

Moderating and mediating mechanisms may operate simultaneously, and it is easy to imagine scenarios in which the two mechanisms either reinforce or counteract one another. This may be one of the reasons why it is a difficult task to sort out which factors influence the relation between SES and achievement. Below we first review the effect of collective SES on achievement, and then we review other factors influencing the relationship between family SES and achievement.

1.3. Equity and the effect of collective SES

Given that classrooms, schools and neighbourhoods differ with respect to the SES of their members, we can think of a collective SES, defined within a multi-level framework as the mean level of SES of the members of the group (Yang & Gustafsson, 2004).

School-SES or collective SES may exert both additive and interactive effects on educational achievement. Rutter, Maughan, Mortimore and Ouston (1979) concluded that there were effects of schools as social institutions even after the student SES was controlled for. Such school differences may, or may not, be due to collective SES, but given the strong relations between school SES and school achievement typically found (Sirin, 2005), it is necessary to take school SES into account.

Collective SES shapes the overall learning environment through its association with social mechanisms and factors which may influence educational outcomes at different levels. These mechanisms include social stratification, peer effects, contextual effects, educational choice and self-selection, as well as institutional differentiation (e.g., Coleman, 1988 Thrupp, 1999; Thrupp, Lauder & Robinson, 2002; Van de Werfhorst, & Mijis, 2010). Numerous studies have concluded that students who attend low-SES schools perform worse than students who attend high-SES schools, even after controlling for students' family background and their ability upon entry to school (e.g., Liu, Van Damme, Gielen, & Van Den Noortgate, 2015; Palardy, 2013; Schmidt, Burroughs, Zoido, & Houang, 2015; Van Ewijk & Slegers, 2010). Thus, there are reasons to assume that the disparity in educational outcomes of different schools is partially determined by differences in the social and institutional factors that are associated with school SES, over and above effect of individual SES.

Van Ewijk and Slegers (2010) found in a meta-analysis a substantial variation in estimates of effects of school SES. They argued that the lack of consensus may partly be due to methodological issues related to operationalization of SES, and partly to lack of control for omitted variable bias.

Previous research (e.g., OECD, 2013), has shown that equitable educational systems tend to achieve better results than non-equitable educational systems. Different indicators of equity have been used, such as dispersion of student achievement, amount of school differences in achievement, the within-school regression of student achievement on student SES, and the between-school regression of school-level achievement on school-SES. It is important to determine the characteristics of different measures of equity, and how they relate to country level achievement.

1.4. School factors influencing the relation between student SES and achievement

Up until the mid-1990s the prevailing view among many groups of researchers, and particularly among economists, was that resources matter little for educational outcomes (Burtless, 1996; Hanushek, 1989). However during the last couple of decades new methods for synthesizing results from different studies and an increased number of high-quality studies have changed this negative view. Using meta-analytic techniques Greenwald, Hedges, and Laine (1996) concluded that there is quite a strong relationship between school resources and educational results. Several studies also found that the effects of resources, such as class-size, were stronger for low SES students than high SES students (e.g., Finn & Achilles, 1999; Krueger, 2003; Nye, Konstantopoulos, & Hedges, 2004; Wenglinsky, 1998; see also more recent reviews on class-size effects by Ehrenberg, Brewer, Gamoran, & Willms, 2001 and by Ecalle, Magnan & Gilbert, 2006, which present more complex patterns of results). One interpretation of the interactive effect was that in schools lacking adequate resources to compensate low SES students for their less adequate preparation, the outcomes will to a larger extent be based on the students' family background (e.g. Wenglinsky, 1998). A recent reanalysis of the Coleman data by Borman and Dowling (2010) investigated the effects of school-level SES and school resources. They showed that within-school variation of achievement is explained by ability tracking and

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