# USING PISA TO EXAMINE EDUCATIONAL INEQUALITY

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**Abstract:** *Educational equity can be measured by the degree to which student academic outcomes are patterned by group differences. In more equitable national education systems, the influence of gender, ethnicity, race, immigrant status or social class on students' academic outcomes is slight. Comparative research can illuminate how educational policies, structures and practices either mediate or exacerbate group differences in student academic outcomes. The Programme for International Student Assessment (PISA) is an especially useful cross-national dataset for measuring equity and developing theory about the influence of policy and practice on educational inequality. This paper examines the features of PISA that are useful for analysing educational inequality. It then reviews how PISA has been used to analyse educational equity, and synthesizes the findings from these various studies into a larger theoretical framework. The paper concludes by discussing how PISA could be further used in future lines of research.*

**Key words:** *Educational inequality, PISA, cross-national analysis, student achievement*

## Introduction

Since 2000, the Organization for Economic Cooperation and Development (OECD) has been administering an international test of student achievement, the Programme for International Student Assessment (PISA). PISA is administered every three years, so we now have three datasets from 2000, 2003 and 2006. All OECD member countries, as well as some non-member countries, have been participating in PISA.

PISA assesses 15-year old students' literacy in four domains: mathematics, science, reading and problem-solving. PISA is not designed to test students' mastery of any given curriculum. Rather, it tests students' ability to apply knowledge in scenarios common throughout all industrialized societies. It thus tests students' general literacy and numeracy in a broad sense. Moreover, PISA is designed to be relevant to all member countries. Each country participating in PISA has the opportunity to select test items that are not appropriate to its particular socio-cultural context. These questions are then struck from the test, thus ensuring that all questions are culturally relevant to participating countries.

The aim of PISA is to provide data and evidence for countries seeking to improve student learning. It is thus intended to provide policy makers and researchers with

tools for determining best practice. It also serves as a mechanism for benchmarking an educational system with other national systems, as well as tracking changes within individual systems over time. While not directly encouraging the wholesale adoption of foreign practices, PISA is designed to provide an evidence base upon which countries can view policies and practices that may be useful or that could be adapted for their unique national context. This is the applied aspect of PISA.

While PISA is often used as a cross-national league table of educational systems, it can also serve the needs of basic research. It has great potential for developing theory and knowledge about the ways in which different structures, policies and practices lead to different educational outcomes. Rather than providing a "recipe" for best practice, this use of PISA develops understanding of the conditions that lead to student learning, as well as the boundaries and parameters that constrain it.

While PISA assesses academic outcomes, it also contains a rich amount of student and school background information. Students complete an in-depth questionnaire about their family background, attitudes toward their school and teachers, school experiences, and educational expectations. Principals of participating schools also complete a questionnaire about their school and teaching staff. While these features of PISA will be discussed in more detail later in the paper, they are mentioned here to illustrate the potential of PISA for providing information about a large range of issues that may foster or hinder student learning, and that may be associated with educational inequality.

This article provides an overview of the ways in which PISA can be used to examine educational inequality and equity. It discusses how researchers have used PISA to extend our understanding of educational inequality. The paper concludes with a brief discussion of further ways that PISA can be used to contribute to the research literature on educational inequality. Due to space constraints, the paper discusses primarily cross-national rather than single country case-studies of PISA. Where relevant, studies that have examined other sources of data have also been included to provide context and further support for the discussion of PISA's contribution to theory about educational inequality.

Features of PISA relevant for examining educational equity

The first feature of PISA that is relevant for examining educational equity is its rich measure of student socio-economic status (SES). SES in PISA is called educational, social and cultural status (ESCS). It is an index of three measures: highest parental educational status, highest parental occupational status, and economic and cultural resources available to the family. The economic and cultural resources measure is itself an index of a large number of questions about objects and behaviour, including: the number of computers, books and original artworks in the home, number of bedrooms, and possessions such as a dishwasher or piano, as well as frequency of visits to libraries, museums and art galleries. It thus provides a very detailed and comprehensive measure of the cultural and economic capital available to a given student. These three dimensions are then computed into a

single ESCS score. PISA's index of socio-economic status is much more refined and comprehensive than datasets that divide students into binary SES categories (e.g., receiving government assistance or not), or that only include one dimension of socio-economic status (e.g., father's occupation).

In addition to SES, PISA asks students about other personal characteristics that may be relevant to researchers examining group-based educational inequality, including gender, linguistic background and immigrant status. Students are asked whether the language they speak at home is the same as the language spoken at their school, where they were born (i.e., whether they are not native born or if not, where overseas), as well as where their parents were born. Individual countries are also able to ask native-born students about their ethnic status if deemed appropriate. Depending on the country, this could mean asking students if they identity themselves as indigenous, Roma, North African, etc. In this way policymakers and researchers can evaluate whether particular groups are especially prone to educational disadvantage.

Based on these student characteristics, researchers can compute measures of the social composition of participating schools. For example, researchers can average the ESCS scores of the participating students in a given school to determine the socio-economic composition of the school (i.e., middle class, working class, etc.). Other measures of school composition include gender (single-sex or co-educational), ethnicity (percentage of students from particular ethnic backgrounds), immigrant status (percentage of students born overseas), or linguistic background (percentage of students who are native speakers). Of course, a measure of school composition is a proxy for the school, since only a sample of the students at any given school participates in PISA. Researchers must therefore treat calculations of school composition with caution. Nonetheless, the ability to calculate a proxy measure for school composition is an immense advantage of PISA. Some other datasets use rough measures for estimating school socio-economic composition, such as the postal code of the surrounding community. Such a measure is easy to calculate but is obviously not always accurate, as a particular school may enrol more students from certain socio-economic or cultural backgrounds than others.

In addition to questions about their family background, students are asked specific questions about their attitudes toward their teachers, school, and education in general. For example, students are queried about their relationships with teachers, sense of belonging to their school, time that teachers spend on classroom management, relevance of their schooling experiences, and post-secondary educational expectations. They are also asked if they are attending the closest neighbourhood school or not. These questions can provide researchers with important information for examining the relationship between student and school characteristics.

Principals are also asked to complete a questionnaire about their school's sector or type, resources, policies and climate. A subset of questions pertains to the teaching staff, including the school's ability to attract and retain teachers, teacher morale, and teacher qualifications. School policies include the school's admission

criteria and selectivity. Both the student and principal questionnaires provide useful information about school funding and sector. These variables can provide useful information to researchers analysing the relationship between equality of student outcomes with school funding, school resources, school sector, school structure (comprehensive or differentiated), parental school choice or school selectivity.

While PISA offers rich information about schools and students, it is not without disadvantages in terms of studying educational inequality. The first disadvantage is that PISA does not measure students' prior ability. It is therefore difficult to make causal claims about the relationship between student and school variables and student outcomes. For example, researchers may find that schools that enrol large numbers of students from high socio-economic backgrounds also have high levels of academic achievement, but it could be the prior ability of the students, not their socio-economic status, that is influencing the outcomes.

Another disadvantage of PISA is its cross-sectional, not longitudinal, design. As PISA by definition assesses 15 year-old students, each PISA cycle measures a different and unique group of students. Since we cannot trace how a particular student's academic achievement changes over time, we cannot make causal claims about the impact of particular school structures or policies on student outcomes.

## What has PISA shown us about educational inequality?

Many researchers and policymakers have argued for decades that comprehensive systems of secondary education are more equitable than differentiated ones. Data from PISA has not only confirmed that comprehensive systems are generally equitable, but also shown that they can promote overall higher levels of learning, thus countering the claim that comprehensive systems promote equity at the expense of quality (OECD, 2004a, 2005). Rather than reducing the proportion of students performing at the highest level of proficiency, many comprehensive systems are able to increase the proportion. Most of the top performing countries on PISA have comprehensive systems of secondary education, including Finland, Korea and Canada. On the other hand some comprehensive systems, such as the US, do not perform above the average. Thus it is likely but certainly not guaranteed that comprehensive systems are more equitable than differentiated systems.

Related to this is the finding that the ability of secondary schools to select students often exacerbates educational inequality. School selectivity reproduces social inequality because higher SES students are more likely to receive the type of academic education that contributes to higher performance on PISA (OECD, 2004a, 2005). Indeed, the association between individual SES and performance on PISA is strongest in the central European countries, which have a long tradition of selective and differentiated secondary education, compared to other OECD countries (OECD, 2004a). An OECD secondary analysis of PISA has shown that school structure/selectivity is the largest influence on student achievement, followed in descending rank of influence by student socio-economic status, school socio-economic composition, then school resources and climate (OECD, 2005). In

comprehensive systems, most schools do not select their students, although plenty of exceptions exist. By contrast, many schools, especially those offering general academic education, select students based on entrance examinations and other assessments of student ability in differentiated systems.

Findings from PISA suggest that a range of educational policies can reduce group-based educational inequality. The first and perhaps most important policy is to reduce selectivity within the educational system (OECD, 2005). Obviously for differentiated systems this would entail a radical change, as this type of structure is based on the notion that schools select their students. Many countries with comprehensive systems also have selective schools, however. Researchers have found that some nominally comprehensive secondary schools in the UK are more likely to select some students over others (West & Hind, 2006). In their secondary analysis of PISA, Jenkins et al (Jenkins, Micklewright, & Schnepf, 2006) found that 28 percent of English secondary students attend a school that selects students based on academic ability or the recommendations of feeder schools. And finally, it should be recognized that comprehensive schools can also "select" students by charging high fees. The point is that selection can occur in both differentiated and comprehensive systems, and through a variety of mechanisms. From a policy standpoint, however, selectivity that is structurally and institutionally embedded in the system – via differentiated secondary schools, for example – plays a very significant role in reproducing educational and social inequality.

Curricular differentiation between institutions (as in differentiated secondary education systems) or within institutions (tracking or streaming) mediates the relationship between student SES and academic achievement in many countries. Using data from PISA, Marks and associates (Marks, Cresswell, & Ainley, 2006) have shown that curriculum differentiation due to school type or within school tracking explains 60 percent of the association of student SES with academic achievement. This is another reason why differentiated systems in particular show stronger associations between student SES and student outcomes and are therefore less equitable. In differentiated systems, the curriculum varies greatly by school type. An exception here is the Netherlands, which has a core curriculum for the first three years of lower secondary education (OECD, 2004b); notably, the Netherlands is an exceptional case of a high-performing, fairly equitable differentiated secondary system.

Even in comprehensive systems, however, curriculum can vary by school. Edwards (2006) has shown that curriculum differentiation is occurring in Australia between public and private schools, and between high SES and low SES schools. Using TIMSS data, Lamb & Fullarton (2002) show that curricular differentiation due to tracking within schools explains up to one-third of variation in student achievement in the US and Australia.  Curricular differentiation has also been documented in New Zealand (Thrupp, 1999) and the US (Jaafar, 2006; Oakes, 2000; Tate, 1997). A centralized curriculum valid for all schools, as is common in many comprehensive systems, could reduce educational inequality (Wößmann, 2000), although it would not necessarily reduce curricular differentiation within schools.

Moreover, experience from Australia would suggest that a centralized curriculum framework valid for all schools within a given state does not remove the possibility of substantial between-school differences in curriculum orientation.

Student intake is also strongly associated with student achievement. When the SES of the students within a school is measured at an aggregate level, we can call this "mean school SES." All things held equal, a given student will tend to perform at a higher level if placed in a higher mean school SES than in a lower one (OECD, 2004a, 2005). Indeed, PISA has shown that in most countries, mean school SES is more strongly associated with student achievement than is individual SES (OECD, 2004a). This finding confirms earlier studies that have found that the association between academic achievement and mean school SES is similar as with individual SES (Rumberger & Palardy, 2005; Sirin, 2005).

While the OECD reports show that the achievement of all students is strongly associated with the mean SES of their school, they have not explicitly showed that the association is equal for all students. In other words, the findings discussed in the reports do not rule out the possibility that the association between mean school SES and academic achievement is stronger for lower SES students than for their higher SES peers. To examine this possibility, we (Perry & McConney, 2008) conducted a secondary analysis of the Australian PISA 2003 dataset. We found that the association between mean school SES and student achievement is similar for all students, regardless of their individual SES. In other words, the association between mean school SES and academic achievement is just as strong for high SES students as it is for their lower SES peers.

The OECD's findings about mean school SES suggest that increases in mean school SES are associated with consistent increases in student achievement. The reports have not examined the possibility that the relationship between mean school SES and academic achievement might show a curves or bumps, or even flatter portions. A review of the literature about school composition has likewise not revealed any studies that have explicitly examined whether the strength of the relationship changes as mean school SES increases. We therefore decided to examine this question as well, again using the Australian data from PISA 2003 (Perry & McConney, 2008). We found that increases in mean school SES are associated with consistent increases in academic achievement. The relationship between mean school SES and academic achievement in Australia does not weaken as the mean school SES increases; rather, we found that the association becomes stronger as mean school SES increases. In simplified terms, moving from a low SES school to a middle SES school is associated with smaller gains than moving from a middle SES school to a high SES school, although the pattern generally shows a positive and largely linear relationship.

Schools that enrol large numbers of students from middle or upper SES backgrounds tend to have higher academic performance than have socio-economic composition of a school for a variety of reasons. Overall, schools with a higher mean SES tend to have more favourable educational conditions than schools with a lower mean SES (OECD, 2005). These more favourable educational conditions

derive from both student- and school-level factors. Due to their social and cultural capital, higher SES students are more likely to succeed in school than their lower SES peers. When large numbers of such "capital rich" students are concentrated in a classroom or school, a culture of achievement often develops and further supports the students in their academic endeavours (OECD, 2004a).

Higher SES schools are also more likely to be better resourced than lower SES schools. For example, researchers in the US have found that lower mean SES schools typically differ substantially than higher mean SES schools. Compared to higher SES schools, teachers in lower SES schools have lower expectations of their students, assign them less homework, are more likely to be teaching out-of-field, and are less qualified (Darling-Hammond, 2007; Orfield, 1996; Rumberger & Palardy, 2005; Tate, 1997). Lower SES schools often have fewer material resources than higher SES schools, at least in the US (Tate, 1997). The OECD has argued that school-level factors, including resources, learning environment, climate and policies, play a relatively small role in explaining variations among student achievement (OECD, 2005). Yet, other OECD reports of PISA note that these factors might be obscured since they are highly correlated with the socio-economic composition of schools (OECD, 2004a). In other words, it is likely that student and school SES variables subsume differences between schools that may be reflected in school climate, policies and resources. Chiu and Khoo's (2005) secondary analysis of PISA would confirm the argument that differential levels of resources available to schools is associated with educational inequality.

As school socio-economic composition is strongly associated with student outcomes, many researchers are concerned about the potential of school choice to increase school segregation by SES, and therefore exacerbate educational inequality. Yet researchers have used PISA to show that parental choice of school can actually reduce school segregation by SES, not exacerbate it (Gorard & Smith, 2004; Jenkins, Micklewright, & Schnepf, 2006). These researchers have shown that institutional differentiation and diversification, not parental school choice, are strongly associated with inequitable student outcomes. School choice, by contrast, can apparently counteract the effects of residential segregation.

In summary, results from PISA suggest that educational inequality can best be tackled by making schools more similar to each other in terms of curriculum, resources, and students. Specific measures include reducing curricular differentiation between and within schools, reducing institutional diversification, reducing the ability of schools to select students, promoting inclusive (non-segregated) schooling, and providing an equitable distribution of resources. Promoting parental school choice within a comprehensive, undiversified system may actually lessen educational inequality by reducing school segregation by SES.

## Conclusion: How else can we use PISA?

Blossfeld and Shavitz's (1993) classic comparative study showed that education policies alone are not that effective in reducing educational inequality in access to

higher education. Rather, they argued that public policies that reduced poverty and promoted social mobility were perhaps even more effective than educational policies, such as lowering entrance requirements to universities or providing scholarships to low-income students, in improving access to higher education for lower SES students. While a more recent study has argued that this conclusion may no longer be true (Marks & McMillan, 2003), the general insight is still valid. That is, are social policies that increase the economic, social and cultural capital available to lower SES students also responsible for ameliorating educational inequality?

One way to answer this question could be to analyse how working class students vary across countries. We know that the performance of higher SES students is relatively consistent across countries, but the performance of lower SES students varies significantly (Lokan, Greenwood, & Cresswell, 2001). Similarly, we know that immigrants from some cultural backgrounds are more likely to experience educational success than other immigrants, and that this success is likely due to their cultural heritage and social capital than to educational policies or practices *per se* (OECD, 2004a). These findings lead to the question whether some countries are better able to serve their lower SES students because these students are more similar to their higher SES peers? In other words, are class differences less extreme in some countries than in others, and is this associated with different levels of performance? Future studies could use PISA to compare working class students across countries. Specific student-level variables in the PISA dataset that could be useful include questions relating to cultural capital (e.g., cultural possessions and participation) and social capital (e.g., attitudes toward schooling and post-secondary educational aspirations). Examining these student-level variables could shed light on the role of educational and general social policies in reducing educational inequality.

Similarly, future research could examine differences between schools. Do schools with large numbers of lower SES students look different than middle class or higher schools, and does this vary across countries? Are there differences between teacher morale, discipline climate, teacher-student relationships, teacher recruitment and retention, and material resources? As noted earlier, much of the research about school differences due to socio-economic school composition comes from the US, a country that is characterized by wide disparities in the funding and resources available to schools. We know much less about how school-level variables might vary in countries with more equitable school funding and resourcing. A comparative analysis of the ways in which schools differ from each other, across a range of national contexts, could develop theory about the mechanisms that mediate the relationship between mean school SES and student achievement.

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