

# PISA AND THE PERFORMANCE OF EDUCATIONAL SYSTEMS\*

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## ABSTRACT

School learning outcomes can be influenced by a diverse set of factors. Through its contextual questionnaire, PISA survey (OECD, 2004; 2007) provides important indications for highlighting the relationships existing between the most significant of these factors and the performances of educational systems in OECD countries participating in the survey. The article distinguishes between factors that play, respectively, a significant role, a less significant role and those whose role on students' attainments is not yet clearly defined. It also outlines some recommendations in so far as school policy is concerned and some suggestions for future analysis.

**Keywords:** PISA survey – Learning outcomes – Socio-economic background – School factors – Educational programmes

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## ESTRATTO

Diversi fattori sembrano influire sui risultati degli apprendimenti a scuola. L'indagine PISA (OECD, 2004; 2007), attraverso il questionario contestuale, offre indicazioni interessanti che permettono di cogliere relazioni tra i più significativi di questi fattori e le performance dei sistemi educativi degli stati OCSE che compongono il campione analizzato. L'articolo distingue rispettivamente tra quei fattori che hanno influenza notevole, scarsa o non ancora chiaramente definibile sui risultati degli studenti e propone alcune riflessioni per le politiche educative, nonché spunti per future indagini esplorative.

**Parole chiave:** Indagine PISA – Risultati di apprendimento – Status socio-economico – Fattori scolastici – Indirizzi scolastici

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## 1. Introduction

School learning outcomes, as measured for instance by PISA, can be influenced by many factors. Indeed the education production function is a very large one with many explanatory variables. Fortunately, thanks to its contextual questionnaire, PISA itself can answer some of the questions which are often asked. For sure those are indications, as the questionnaire does not test the correlation which can exist between the different variables and learning outcomes, nor can it measure the respective importance of these variables. But these indications are precious as they can already explain and enlighten several issues related to the performance of educational systems.

It is difficult to strictly list all the factors influencing student performance. But apart from the socio-economic background of schools and students which is certainly among the main factors, twenty five other factors can be identified. They relate to system and schools, resources, classes, teachers, students and finally parents, as summarised in Table 1.

**TABLE I**  
**Twenty-five school factors influencing student performance**

System/Schools	Resources	Classes
<ul style="list-style-type: none"> <li>• Educational standards</li> <li>• School autonomy</li> <li>• Institutional differentiation</li> <li>• Public/private school</li> <li>• School size</li> <li>• School admission policy</li> </ul>	<ul style="list-style-type: none"> <li>• Number of qualified teachers</li> <li>• Physical infrastructures</li> <li>• Learning time</li> <li>• ICTs</li> <li>• Curriculum</li> </ul>	<ul style="list-style-type: none"> <li>• Size</li> <li>• Discipline</li> <li>• Student support</li> <li>• Pedagogy</li> </ul>
Teachers	Students	Parents
<ul style="list-style-type: none"> <li>• Salary and working conditions</li> <li>• Motivation</li> <li>• Education/development</li> <li>• Teachers assessment</li> </ul>	<ul style="list-style-type: none"> <li>• Motivation</li> <li>• Sense of belonging</li> <li>• Students assessment</li> <li>• Students-teachers relations</li> </ul>	<ul style="list-style-type: none"> <li>• Expectations</li> <li>• Involvement</li> </ul>

Intuitively, one would conclude that all those factors have a strong influence on learning outcomes. But evidence shows that once taken into account the socio-economic background of schools and students, the effects are often less clear. A detailed analysis of each factor is hence necessary. This can be done thanks to the answers to the contextual questionnaires PISA provided in both the 2003 and 2006 cycles. However pedagogy and curriculum are excluded from this analysis as no information is available in these areas for obvious reasons. Information is also lacking as regards the salary and working conditions of teachers, their education and training and their assessment (some related information will be soon available thanks to the international survey on teaching and learning recently launched by the OECD, TALIS).

## 2. System/schools factors

### 2.1. Schools' standards

Students of parents who strongly agreed or agreed that achievement standards are high in their child's school scored in PISA 2006, on average in the 16 countries where the information is available, 21 points higher than students with parents who disagreed or strongly disagreed with that statement. This represents a fifth of a standard deviation or half a year of additional education (OECD, 2007, p. 197). In some countries (Korea and Germany for instance) the advantage is between 30 and 48 score points.

### 2.2. School autonomy

School autonomy can relate to staffing, budgeting and educational content. While school level autonomy indices in the three criteria do not show a significant association with student performance after accounting for background factors of students and schools, at the system level, students in educational systems giving more autonomy to the last two criteria tend to perform better (an increase of one unit on the index corresponds to an increase of 20.3

and 22.5 score points in science respectively; OECD, 2007, p. 253).

### 2.3. *Institutional differentiation*

Institutional differentiation is a mechanism for dividing students into separate types of education (academic, professional or technical) which implies different qualifications at the end of the programme. In some countries, e.g. Germany and Austria, this differentiation is made at an early stage (end of primary school). Often, differentiation is associated with socio-economic segregation. Evidence shows that the number of school programmes accounts to 52% of the share of the OECD average variation that lies between schools. Institutional differentiation is related to the greater variation of student performance and the greater socio-economic selectivity. These relationships are not straightforward, but the following three explanations could be given. First, in homogenous environment, while high-performing student may profit from the wider opportunities to learn from one another, low performers may not be able to access effective models and support and consequently achieve lower. Second, in institutionally differentiated systems it is easier for teachers to move students not meeting certain performance criteria to other schools or other tracks rather than investing the effort to raise their performance. Finally, heterogeneous environment may stimulate teachers to use approaches that involve a higher degree of individual attention for students, but this may not occur in homogeneous environment (OECD, 2007, p. 222).

### 2.4. *Private/public school*

In OECD countries, private schools tend to perform better than public schools in 12 countries among the 22 for which the information is available. But once socio-economic factors of students and schools are taken into account, public schools outperform private schools in 7 countries. This confirms the influence of learning environment which depends upon socio-economic background of intake on learning outcomes (OECD, 2007, p. 230).

### 2.5. *School size*

School size tends to have a small effect on school performance, an advantage even smaller when taking into account socio-economic factors (OECD, 2004).

### 2.6. *School admittance policy*

Not surprisingly, schools reporting higher degrees of academic selectivity tend to perform better. Even after socio-economic backgrounds of students and schools are taken into account, the effect on performance is still high. This would be simply because schools do not accept poorly performing students and not necessarily because they provide better services. Education systems with a greater proportion of selective schools, however, do not perform better, other factors being equal. This result suggests that while individual schools benefit from more restrictive admission policies, an education system as a whole does not benefit from it (OECD, 2007, pp. 226-227).

## 3. Resource factors

### 3.1. *Number of qualified teachers*

As expected, students enrolled in schools where principals reported a high degree of teacher shortage tended to perform lower. But this disadvantage is not significant once socio-economic factors are taken into account (OECD, 2007, p. 263).

### 3.2. *Physical infrastructures*

Suitable physical infrastructures may clearly not guarantee high performance. But the absence of such an environment could certainly affect learning negatively. No discernable pattern can be observed between the two groups of countries, i.e. the best performing countries (Australia, Canada, Finland, Japan and Korea) and the low performing ones (Greece, Italy, Mexico, Portugal and Turkey): indeed, rela-

tively few principals reported that the schools' capacity to provide instruction was hindered by a shortage of schools buildings in Australia, Canada, Japan and Portugal. But the other way around prevails in the other countries (OECD, 2004; Table 5.17).

### 3.3. Learning time

On average, students in OECD countries are expected to receive 6,907 hours of instruction between the age of 7 and 14 (OECD, 2008, p. 412). Whereas among some of the best performing countries the average number of hours is low (e.g. Finland, Japan and Korea), this number is quite high in others (Australia and the Netherlands). Similarly, whereas among some of the low performing countries the average number is quite high (Italy, Portugal, Greece and Mexico) it is rather low in other (Turkey). However, in PISA 2006, it was found that school average students' learning time for regular lessons in school is significantly related to the performance, even after accounting for socio-economic background factors.

### 3.4. ICTs

The percentage of students in schools whose principals reported that the capacity to provide instruction was hindered by shortage of computer for instruction is below 40% in the five best performing countries Australia, Canada, Finland, Japan and Korea. But the same percentage prevails in Greece and Italy whereas it is above 50% in the three other low performing countries, Mexico, Portugal and Turkey (OECD, 2004). It is hence difficult to discern a pattern between shortage of computers and educational performance.

## 4. Classes factors

### 4.1. Class size

One may think that one condition to achieve good learning outcomes is to have fewer stu-

dents per teacher. However evidence shows that the ratio of students to teaching staff varies greatly from country to country and that no relationships can be determined with PISA performance in science. Indeed, as shown by Table 2, this ratio can be quite high in countries with high PISA score such as the Netherlands and be quite small in low performing countries such as Portugal and Greece.

TABLE 2  
PISA score in science and ratio of students to teaching staff in secondary education<sup>1</sup>

	PISA score in science	Ratio of students to teaching staff
Finland	563	12.9
Japan	531	13.7
Australia	527	12.2
Netherlands	525	15.8
Korea	522	18.2
Italy	475	10.7
Portugal	474	7.9
Greece	473	8.2
Turkey	424	15.8
Mexico	410	30.2
OECD average	500	13.2

### 4.2. Class discipline

Disciplinary climate adds on average in OECD countries 27 score points even after taking into account socio-economic factors. It is hence one of the most influential factors (OECD, 2004, Table 5.21a).

### 4.3. Student support

Student support is an essential element of teaching that heavily impacts on learning outcomes. It is quite developed in all countries as shown by Table 3 notably in Finland, Australia, two high performing countries, and in Portugal and Turkey, two low performing countries. (OECD, 2004, Figure 5.1).

<sup>1</sup> Source: OECD (2008). *Education at a glance. OECD Indicators*. Paris: OECD Publishing. Table D2.2.

**TABLE 3**  
**Percentage of students supported in schools as reported by principals**

	Teachers give extra help when students need it	Teachers help students with their learning
Finland	77	86
Japan	62	73
Australia	78	85
Netherlands	66	49
Korea	56	79
Italy	49	70
Portugal	73	82
Greece	62	74
Turkey	74	82
Mexico	66	78
OECD average	66	73

Source: OECD (2003).

#### 4.4. Students-teachers relations

This is a variable with one of the highest impact on learning outcomes as shown by PISA 2003. On average students who strongly disagree that they and their peers get along well with teachers, that most teachers are interested in students' well being, that most teachers really listen to what students have to say, that if students need help they receive it from their teachers and that most of the teachers treat students fairly, show a disadvantage of 74 score points after taking into account socio-economic factors (OECD, 2004, p. 257).

## 5. Teachers factors

### 5.1. Teachers' motivation and engagement

The morale of teachers is obviously an essential factor that might influence the performance of students. Yet it is difficult to determine a different pattern between the best and the low performing countries. Whereas all best performing countries have a percentage of students in schools where the principals agree or strongly agree with the sentence according to which the morale of teachers in their school is high, i.e. above 95%, this is not the case of Korea where

it amounts to 80%. In the low performing countries, this percentage is above 85% in Greece and Mexico and lower in Italy (75%), Portugal (71%) and Turkey (82%) (OECD, 2004, Figure 5.5).

## 6. Students factors

### 6.1. Students' interest

One would think that the highest the interest of students in a subject matter, the higher their performance. However, the percentage of students agreeing or strongly agreeing that they are interested in the things they learn in mathematics is always higher in the low performing countries (Greece, Italy, Mexico, Portugal and Turkey) than in the high performing ones (Australia, Canada, Finland, Japan and Korea; OECD, 2004; Figure 3.2).

### 6.2. Students' sense of belonging

Students' sense of belonging has generally only a small effect. However in countries such as Belgium, Luxembourg and Switzerland, the effect is large even after taken account of socio-economic factors with one unit of this index being associated with a performance difference between 20 and 65 points (OECD, 2004).

### 6.3. Students' evaluation

On average across OECD countries, students in schools that report having a teacher-developed test two times or less per year scored an average of 471 points on the mathematics scale and those where there are three tests per year or more scored at 503 points (OECD, 2004, p. 231).

## 7. Parents factors

### 7.1. Parents' expectations

Among the five best performing countries in PISA, the percentage of students in schools

where the principal reported that regarding high academic standards there is constant pressure from many parents is quite high in Japan, Australia and Canada (above 30%), but it is less than 20% in Korea and less than 5% in Finland. In the five low performing countries, the situation is also very mixed with Mexico and Italy having a percentage above 20%, Greece and Turkey with a percentage below 20% and Portugal with a percentage below 10%. It is therefore impossible to derive any relation between the level of parents' expectations and learning outcomes (OECD, 2007, p. 234).

### 7.2. Parents' involvement

Decision-making patterns clearly vary considerably across OECD countries. School principals most frequently reported that regional or national education authorities exerted a direct influence on decision making followed by school governing boards, teacher groups, external examination boards and then by employers, parent groups and student groups. In the best performing countries as well as in the low performing ones, the percentage concerning parents' involvement in decision making about staffing is very low (less than 6% of percentage of students) in all countries but Mexico where it amounts to 17.7% (OECD, 2007, Table 5.12a).

## 8. Conclusion and policy implications

The Table 4 summarizes the main conclusions of the analysis. Seven factors have a high influence on student's performance; eight have a low influence and four have an influence which cannot strictly be determined.

The policy implications are thus that it is important for schools to set standards and to have them well known by teachers, students and parents. School autonomy is also an important factor as it gives the possibility to schools to have their own staffing policy and to have full responsibility for their budget and possibly educational content. Institutional differentiation is another factor influencing learning outcomes; to the extent

**TABLE 4**  
**Level of influence associated to school factors**

High influence	Low influence	Undetermined influence
<ul style="list-style-type: none"> <li>• Educational standards</li> <li>• School autonomy</li> <li>• Institutional differentiation</li> <li>• Learning time</li> <li>• Discipline</li> <li>• Student support</li> <li>• Students-teachers relations</li> </ul>	<ul style="list-style-type: none"> <li>• Number of qualified teachers</li> <li>• School size</li> <li>• Public/private schools</li> <li>• School admittance policy</li> <li>• Students interest</li> <li>• Students' sense of belonging</li> <li>• Student evaluation</li> <li>• Parents involvement</li> </ul>	<ul style="list-style-type: none"> <li>• Physical infra-structures</li> <li>• ICTs</li> <li>• Classes size</li> <li>• Teachers' motivation</li> <li>• Parents' expectations</li> </ul>

possible, such differentiation should be avoided and when it is introduced it should not be at a too early stage and pathways should exist between the different educational programmes. Learning time is an important factor; however it is the time at school which counts and not the time at home. Discipline and student support as well as students-teachers relations are related factors: the relations between teachers and students are certainly better in schools where student support is developed and where teachers are respected thanks to a minimum level of discipline.

As stated in the introduction, this analysis needs to be completed by some further work; notably some work is necessary to make a full distinction between the respective effects of the identified factors on learning outcomes of students at the individual level, school level and system level.

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