PISA 2003: THE SKILLS OF TEEN-AGERS IN EUROPEAN REGIONS

A Comparison between some Italian and European Regions Casts New Light on OECD Findings

Luciano Abburrà
IRES
Istituto Ricerche Economico Sociali del Piemonte
(Institute for Economic and Social Research of Piedmont)

This paper was produced by a work team from Ires Piemonte. The members of the team are: Luciano Abburrà, Paola Borrione, Luisa Donato and Simone Landini. The chapter on the comparison between Italian and foreign students in Italian schools is by Paola Borrione, Luisa Donato, Simone Landini and Roberta Valetti

Contents

1. A CONTRIBUTION TO THE UNDERSTANDING OF PISA RESULTS THROUGH A COMPARATIVE ANALYSIS OF SOME EUROPEAN REGIONS

1.1 Comparison of students of Northern Italy with other European regions

How do Italian schools perform? How much do Italian students learn? The most frequent answers to these two questions have long been "poorly" and "little".

In the past few years, many have drawn these general conclusions from a very authoritative source: the OECD PISA survey. Based on rigorous criteria and an objective approach, both in 2000 and in 2003 the most prominent international survey on 15-year-old students attributed Italy a very low position in the score ranking of standardized tests on key skills like reading, mathematics and sciences.

Unfortunately, like other studies which are quoted as often as PISA, the latter is rarely known more in depth than what is allowed by reading the quotations themselves. With reference to the 2003 survey, for example, it is well-known that the Italian score in mathematics was 466 versus an average of 500 in 41 participating countries. It was later specified, however, that this poor result conceals wide variations in different areas of the country, to a much greater extent than in most other nations. In Southern Italy and in the Islands scores are definitely lower than the national average, and fully comparable to those of countries ranking last in the international comparisons, like Turkey or Mexico. The results of Central Italy are substantially in line with the national average, with figures similar to Portugal and Greece. The students of the two macro-areas of the Northeast and Northwest of Italy, instead, are much more favourably positioned in the skill ranking system of PISA, both with respect to the other Italian regions and to the international average: their scores are entirely similar to those of neighbouring countries like France, Switzerland and Austria, and higher than Germany and the United States.

If we insist on using PISA as a benchmark, then we should at least answer the two questions raised at the beginning including the above-mentioned territorial differences into our consideration. Despite the lack of any substantial institutional and organizational difference in their educational systems, the results of international tests point to very diverse levels of learning in the different Italian territorial areas considered.

It was against this background that, some years ago, Piedmont proposed to add a regional perspective to the PISA OECD survey in Italy, something that had already been done in

other countries since 2000. Hence the decision of a limited group of Italian regions and provinces to support and implement an extension of PISA 2003 samples, with a view to gaining a regional insight into the report.

The cultural value of the approach and the scientific rigour acknowledged to the OECD methodology were two strong incentives to the initiative, along with the specific comparative method applied in that survey on an international scale. With PISA, each country can thus draw on reliable data on the level and distribution of rigorously defined skills and it becomes possible to compare the performances of students of various countries, regardless of differences in curricula and educational systems.

Now, if this is clearly an opportunity for each individual country, it can also be useful to different regions belonging to the same country. For the regions of Northern Italy, for example, it may only be partly relieving to know that the performance of their students is better than that of other Italian regions, when it is well known that the scores of the latter are exceptionally low. But even a direct comparison with the average performance of other countries would be inappropriate, since every country has diversified situations within its national boundaries. Nor can it be a satisfactory solution to make reference to abstract values like the "OECD average".

Comparisons between inconsistent areas may be even more inadequate if the goal is understanding the reasons and implications of positive or negative differences: given the variety and heterogeneity of factors related to skills, a direct comparison between very diverse areas - not only from a geographical, but also from a demographic, economic, social and cultural viewpoint - would make it difficult to attribute specific weight to each factor, controlling for the others. In particular, other differences could overshadow those depending on specific educational systems or their peculiar organization, management and functioning at a regional or local level.

On the other hand, nowadays the real benchmarks for teen-agers who are preparing themselves for adult life and for work are bound to be international. The globalization of economic systems and the increasing interconnections on a global scale require a re-definition at an international level of the key skills necessary to each individual to participate and be active in these changes.

Hence the idea of developing comparative analyses on PISA data about skills in both a regional and international format. This way, more accurate information can be gathered on

actual skill levels and the way they are distributed among adolescents, by comparing each region with regions in other countries similar from a demographic, sociologic and economic viewpoint.

Furthermore, even a direct comparison between individual regions belonging to the same national macro-areas might offer more information than can be elicited from aggregate data: should there turn out to be consistent differences in quality or level of skills within the same macro-areas – i.e. between the different regions of Northern Italy –, then it might be necessary to reassess previous explanations (which might be biased by aggregation) to the benefit of other possible descriptions that would otherwise be blurred by average data.

Table 1: Average Score in Maths, Reading and Sciences among 15 year-old students in some Italian and European Regions

GEOGRAPHICAL AREA	MATHEMATICS		READING		SCIENCE	
	AVERAGE	S.E.	AVERAGE	S.E.	AVERAGE	S.E.
Piedmont	494	4.9	501	4.0	522	5.2
Lombardy	519	7.3	515	6.9	540	7.5
Veneto	511	5.5	514	6.3	533	6.0
Tuscany	492	4.6	492	6.7	513	5.7
Switzerland (Ger)	527	3.7	500	3.1	513	3.9
Switzerland (Fr)	525	6.2	496	8.0	512	7.1
Switzerland (Ita)	520	5.9	493	8.2	502	7.2
Basque C.	502	2.8	497	2.9	484	3.1
Cataluña	494	4.7	483	4.5	502	4.0
Scotland	524	2.3	516	2.5	514	2.7
OECD Average	500	0.6	494	0.6	500	0.6
ITALY	466	3.1	476	3.0	486	3.1

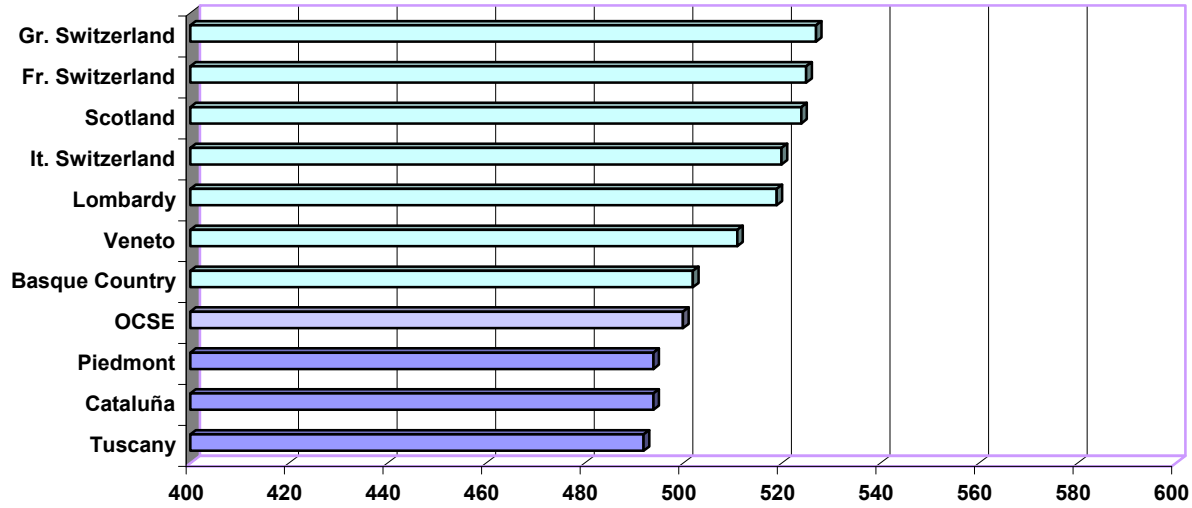
Source : PISA/OECD database – processed by IRES Piemonte, 2005

Some early and general findings of a comparative analysis based on previous assumptions are reported in the following pages.

In short, the study highlights that, based on the international PISA survey test results, it is impossible to provide a clear-cut answer to the questions raised at the beginning of this contribution on the performance of the Italian educational system. The skills of teen-agers in prominent regions of Northern Italy are not just higher than the national average, and therefore very different from those of Southern and even Central Italy. As a matter of fact, in the regions of the North skills are similar to those of comparable regions of other European countries, the average scores of which were much higher than that in Italy: for example, the neighbouring Switzerland, which obtained a score of 527 in maths, versus 466 of Italy. On the contrary, according to the interregional and international comparisons

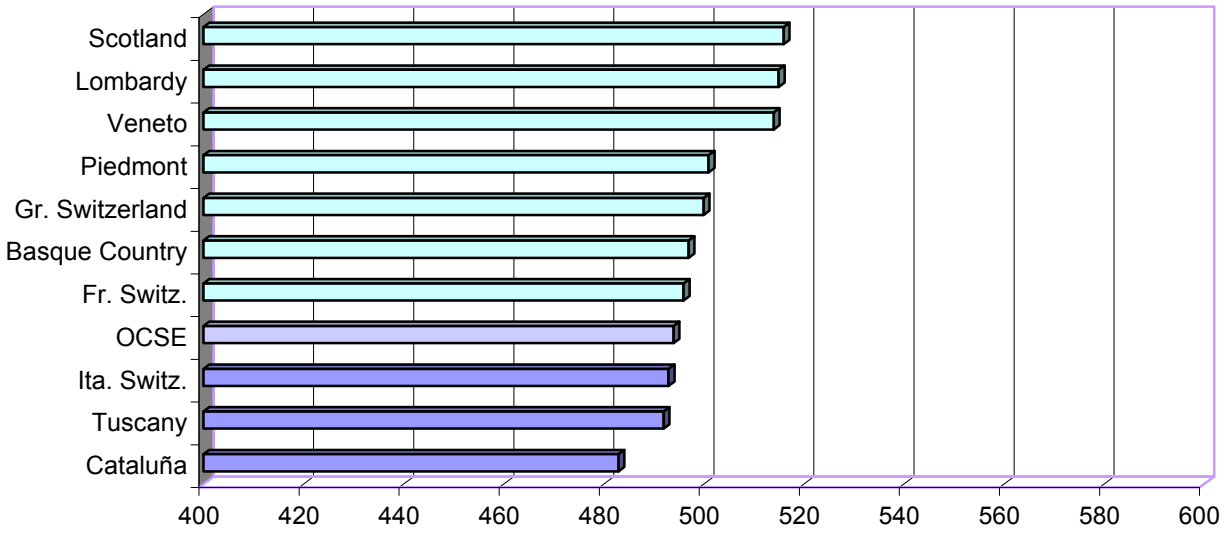
performed for the purpose of this study, the regions of Northern Italy emerge from the evaluation as relatively "specialized" in some key areas like reading and sciences, with scores exceeding those of the other European regions directly compared to them (from countries like Switzerland, Spain and the United Kingdom).

Chart 1: Average Score in Maths among 15 year-old students in some Italian and European Regions



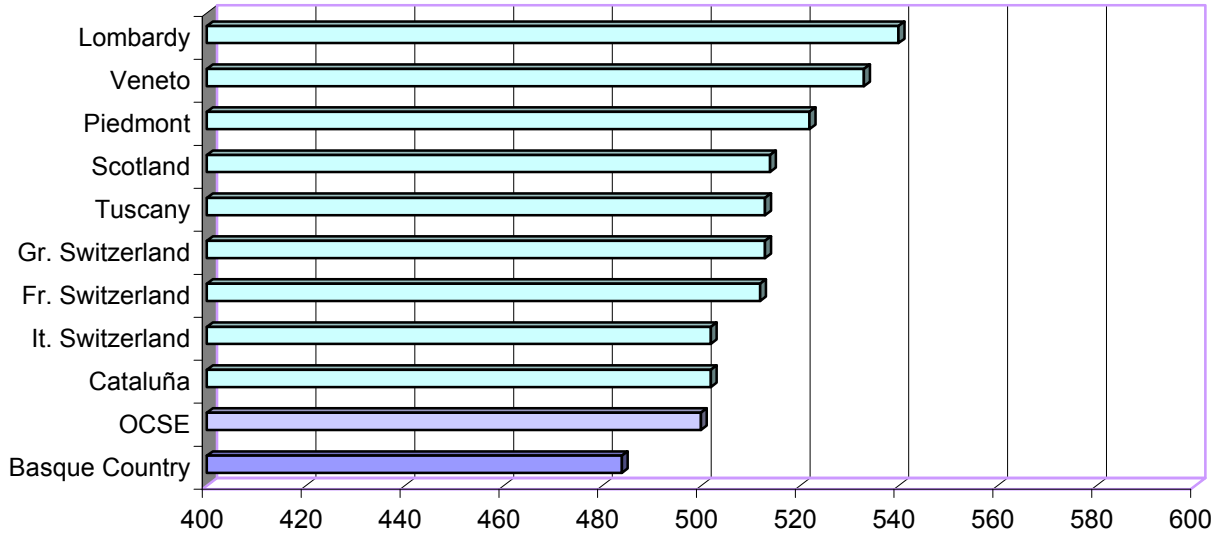
Source : PISA/OECD database – processed by IRES Piemonte, 2005

Chart 2: Average Score in Reading among 15 year-old students in some Italian and European Regions



Source : PISA/OECD database – processed by IRES Piemonte, 2005

Chart 3: Average Score in Sciences among 15 year-old students in some Italian and European Regions



Source : PISA/OECD database – processed by IRES Piemonte, 2005

It is also important to point out that the same score levels are obtained in Northern Italy not only by the students of the most valued secondary schools like Lyceums, but also by students attending Technical Schools, who are the majority in Italian secondary education institutions[1]. Quite interestingly, unlike Italy as a whole, in Northern Italian regions even the students of Technical Schools exhibited average skills in line with the general average of OECD, with scores equal to or even higher than the average scores of Lyceums at a national level, and not very far from the average scores of Lyceum students in the same Northern regions, with wide overlappings in their distribution.

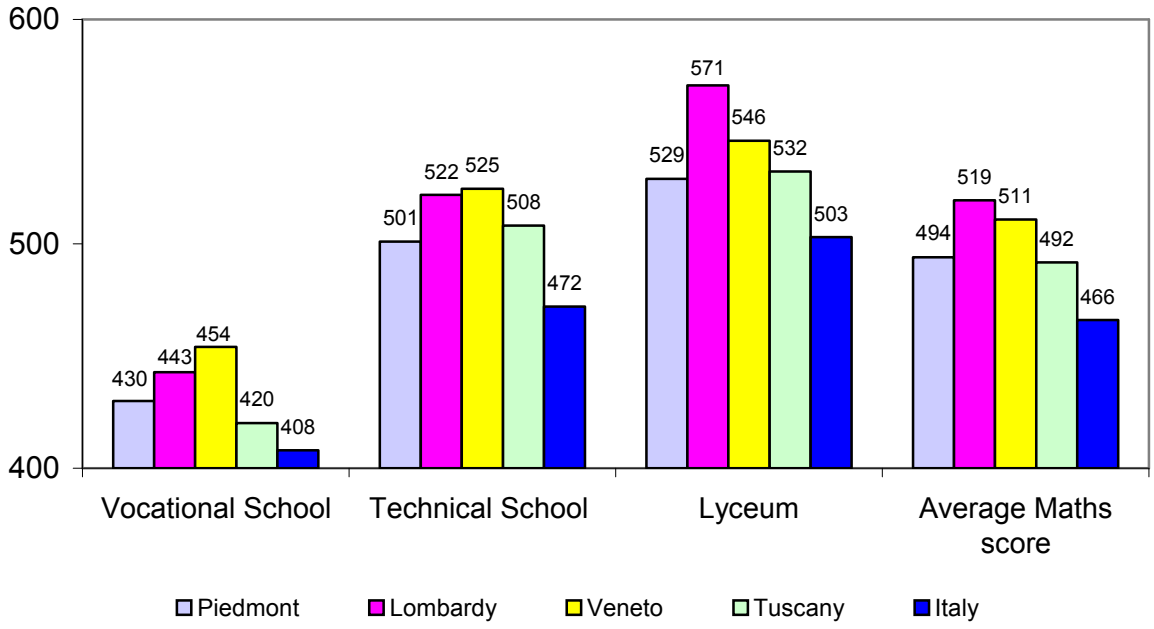
However, in the regions of Northern Italy as well as at national level, the situation of Vocational Schools, which account for 20% of all the students, is considerably different. PISA scores show that the poor preparation of these boys and girls when they leave compulsory education, not only remains definitely lower than that of their peers after about two years of secondary study, but it turns out to be objectively inadequate in a comparative international perspective. With a negative gap of 60-70 points versus the

[1] Technical education has been the object of considerable reform attempts in the past decades, but it is in these schools that not only many supervisers and technicians were educated, but also many managers and entrepreneurs who played key roles in the Italian economy.

OECD average (against the -100 at the national level), even in the regions of Northern Italy the students of Vocational Schools are at a serious disadvantage: a share of 25 to 33% of them scored below the minimum standards deemed by OECD necessary not only to successfully continue education, but also to effectively start working and have good carrier prospects.

A serious rethinking of this specific chunk of education is certainly the most acute and urgent critical measure to be taken for Italy as a whole, and even more so in the regions of Northern Italy, perhaps, because students of other types of schools are much better performers there than elsewhere.

Chart 4: Comparison Between Average Maths Scores in Different Types of Secondary Schools in 4 Italian Regions



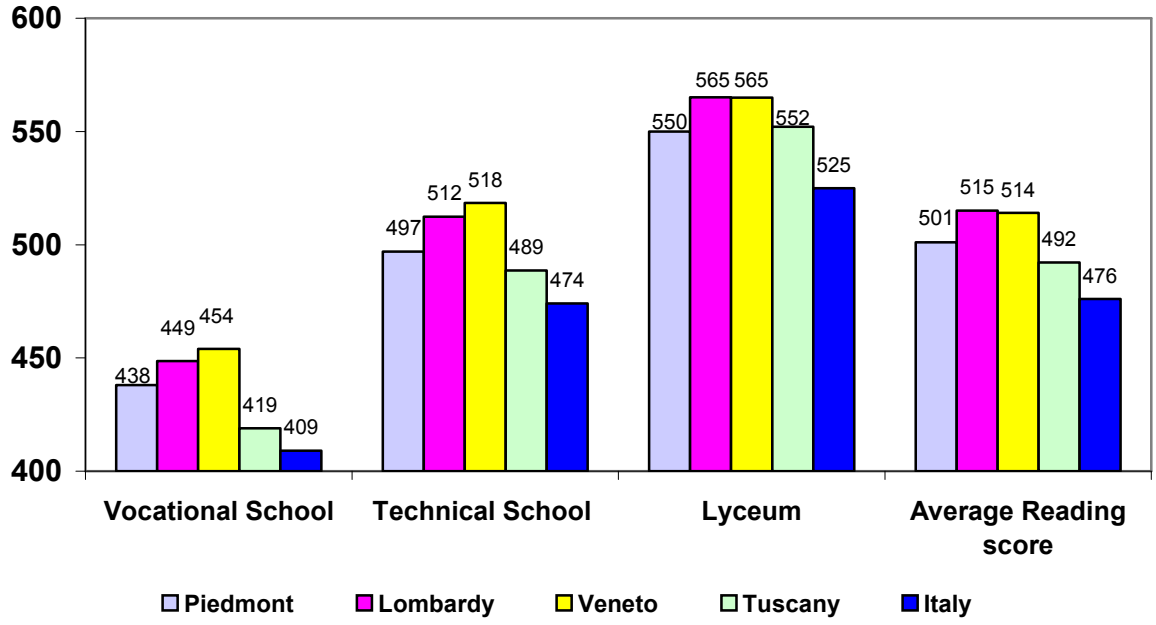
Source : PISA/OECD database – processed by IRES Piemonte, 2005

1.2. Individual differences between the regions of Northern Italy

The above-mentioned interregional comparisons highlight another element hidden by other more comprehensive data representations: even between the regions of Northern Italy differences are not negligible, both in terms of levels and distribution of PISA tests results. Despite the morphological similarity and physical proximity of regions like Piedmont, Lombardy, Veneto and Tuscany, PISA tests results are sistematically different, even when the same types of schools are compared. The constancy and regularity of these

differences may at least partly compensate for the limitations in terms of statistical significance of some individual comparisons.

Chart 5: Comparison between Average Reading Scores in Different Types of Secondary Schools in 4 Italian Regions



Source : PISA/OECD database – processed by IRES Piemonte, 2005

All along the analysis some peculiar regional trends of the educational systems have first appeared and then taken a clearer shape, at least inasmuch as they could be reflected by PISA results. A case in point is the driving role played by Lyceums in pushing the average score of Lombardy very high, with peaks in mathematics and sciences. Veneto, instead, reveals an unusual trend with a very low percentage of poor results both in Technical and Vocational Schools, with a very positive impact on average scores both in maths and reading. And this favourable aspect has no negative impact on Lyceums, the scores of which are almost as high as those of Lombardy. The situation of Tuscany is very polarized instead: Lyceums are substantially in line with those of the Northern regions, while Vocational Schools are closer to the Italian average, with very striking gaps in reading and sciences. Piedmont, finally, highlights another specific pattern, with Vocational Schools almost as problematic as those of Tuscany and a ranking of Technical Schools and Lyceums not as good as that of Lombardy and Veneto: the biggest gaps are in maths, where Technical Schools in Piedmont score 25 points less than in Veneto, and Lyceums are 40

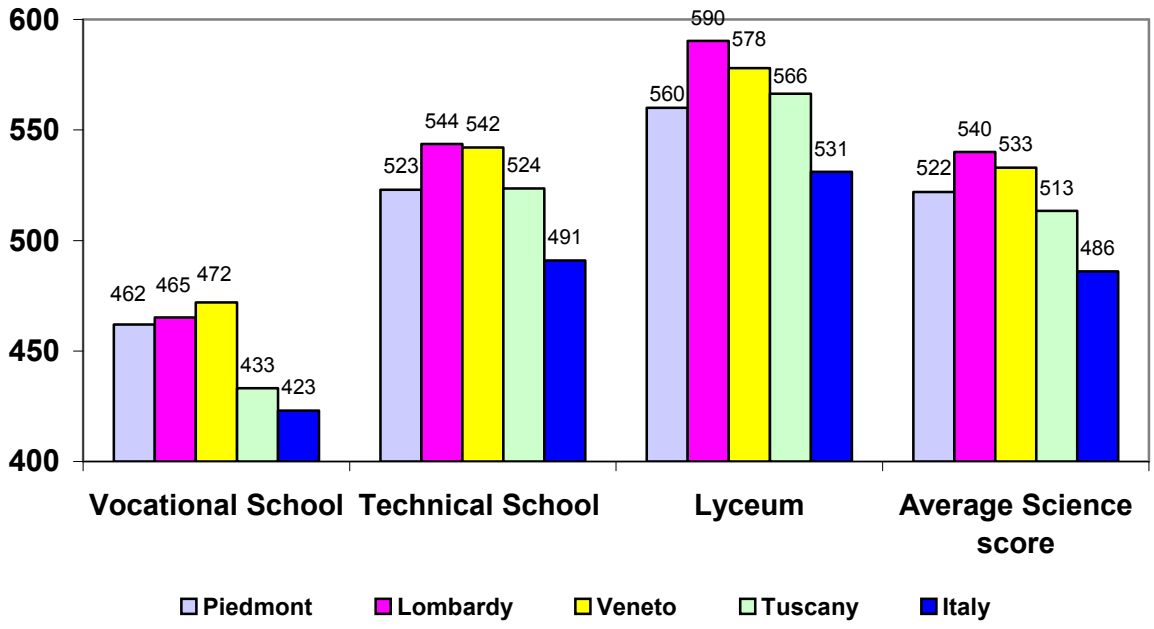
points below those in Lombardy. Still in maths, Vocational Schools in Piedmont obtain 24 points less than in Veneto.

Consequently, the general trend shows that space for local variability within the same educational and institutional system exists, even when comparing regions which are much more similar to each other than the different countries compared at an international level.

This prompts analysts to continue the study in the direction of a better understanding of the reasons and the local mechanisms of this variability. At the same time, the empirical evidence of better performances even within the same kind of schools, shows that it is certainly possible to improve the performance of any individual region, even within the same educational framework.

This inevitably shifts more responsibility to local and regional authorities, both in education and in other relevant policy fields.

Chart 6: Comparison between Average Scores in Sciences in Different types of Secondary Schools in 4 Italian Regions



Source : PISA/OECD database – processed by IRES Piemonte, 2005

1.3. Social, economic and cultural background of students and skills measured in the PISA survey: differences between Italian and European regions

Persisting differences have emerged out of PISA test results in various regions, even between schools of the same type. For the purpose of a comparative assessment, the background of students - i.e. the social, economic and cultural features of their environment - should also be taken into account. Several published reports on PISA international data explored the links between the characteristics of the social, economic and cultural environment of students and their likelihood to positively respond to PISA tests.

Based on the PISA questionnaire filled in by the students and the matching of diverse information concerning their family context, a summary index of the social, economic and cultural status of students was developed[2]. For the purpose of our comparative analysis between different geographical areas, two main contributions can be gathered from this set of indicators: 1) the mean values of status indices in the various areas can be directly compared, to find out whether significant differences emerge and check if their distribution is consistently related to PISA results differences; 2) moreover, it is possible to compare the relative impact of socioeconomic and cultural status on learning in different territorial contexts, as illustrated by PISA, in fact, according to the OECD survey, not only context features are diverse in the different countries considered but, even when the contexts are similar, the influence of socioeconomic and cultural factors on PISA results may vary according to different countries (and regions).

These two analytical steps could allow us a sort of preliminary "check", to see if reported differences or similarities in background conditions may or may not play a relevant role in explaining the performance differences highlighted in PISA tests at a regional level.

In Italy, the average value of the ESCS index (Economic, Social and Cultural Status) is equal to –0,1: it is therefore lower than the OECD average, which is conventionally set at 0, with

[2] This index, called ESCS (Economic, Social and Cultural Status), arises from the combination of three relevant indicators: 1) parent's job, based on the higher occupation according to the ISEI classification (International Socio Economic Index of Occupational Status); 2) their level of education, corresponding to the higher qualification reached by the parents according to the ISCED classification (International Standard Classification of Education); 3) the "cultural goods" owned by the family, based on the HOMEPOSS (Home Possession) index which includes specific equipment such as a desk, a room of his/her own, a quiet place to study, a computer for studying with the relevant software, internet connection, a personal calculator, books of classical literature, poetry books, works of art, reference books which can be a support for studying, a dictionary, etc

a standard deviation of 1. At a regional level the same index varies from –0.1 in Veneto to +0.1 in Lombardy, with Piedmont and Tuscany positioned exactly on the OECD average.
To have some international reference term, one can consider that the index value for both Cataluña and the Basque Country is the same as Veneto (-0.1): well above the Spanish average (-0.3), but lower than the OECD average. Even the combined value for Switzerland is the same as the OECD average, with the three linguistic areas ranging from –0.1 in the German speaking part of Switzerland to +0.1 in the French speaking part. The latter value (+0.1) is also recorded both in Scotland and in Lombardy.
There are therefore clear differences between the European regions considered, but they are not so far-reaching (consistently with the selection and comparison criteria followed in the study). What is even more important, however, is that socioeconomic status differences do not seem to be consistently associated to performance differences: in particular, Veneto and the German-speaking part of Switzerland rank on the status index clearly lower than on PISA results.
Interestingly enough, in Northern Italian regions – and particularly in Veneto again - the performance gap between students positioned at the two extremes of the social scale seems particularly narrow: differences in tests results of 25% of students with a lower ESCS and 25% of students with higher status range from 52 points in Veneto to 74 in Lombardy. If we consider the Italian average, the same difference between the lower and upper quartile reaches 90 points.
Generally speaking, in the European regions compared in the study, differences between the extremes are higher than in the 4 regions of Northern Italy (with the only exception of the Basque Country), and this is even more evident in the German and French speaking parts of Switzerland (with a difference of 103 and 97 points).
The conclusion might be that for the regions of Northern Italy and, in particular, for some of them, levels of socioeconomic status comparable to other European regions considered are matched by smaller discrepancies in performances registered by the students positioned at the two extremes of the social ladder.
With respect to the impact of socioeconomic status on PISA results, another measure adopted in OECD reports is the percentage of results variance "explained", in statistical

terms, by differences in the ECSC index[3]. In Italy, for example, the index "explains" slightly less than 14% of the score variance in maths: this figure is similar to Spain, lower than the 18% of Switzerland and the 20% of OECD as a whole. For Northern Italian regions the influence of status on performance drops further, moving from the lowest value in Veneto (where the differences in socioeconomic and cultural status of families explain only 5.6% of the students' score scattering), up to a maximum of 11% in Tuscany. The corresponding figure is 10% in Piedmont and Lombardy, the same as in the Basque Country. In all the other European regions the explanatory capacity of status gaps is higher: it ranges from 13.8% in Cataluña to 18.8% in the German-speaking cantons of Switzerland.

Table 2: Socioeconomic and Cultural Conditions of Students compared to Maths Scores by Region[4]

INDEX ESCS	*Geographical Area*	*ESCS Index Average*	*Average math score in the lower quartil*	*Average math score in the upper quartil*	*Inter-quartile differ.*	*Change in the math score per unit of the index ESCS*	*Explained Variance % ESCS*
ESCS Index of economic, social and cultural status	Piedmont	0.0	459	528	69	30	10.6
	Lombardy	0.1	485	559	74	31	10.1
	Veneto	-0.1	485	537	52	21	5.6
	Tuscany	0.0	451	524	73	30	11.0
	Switz. (Ger)	-0.1	470	573	103	50	18.8
	Switz. (Fr)	0.1	477	574	97	45	18.5
	Switz. (Ita)	0.0	479	560	81	39	15.5
	Cataluña	-0.1	452	535	83	33	13.8
	Basque C.	-0.1	471	538	67	29	10.7
	Scotland	0.1	482	573	91	39	18.1

Source : PISA/OECD 2003 database – processed by IRES Piemonte, 2005

The positive meaning of a lower influence of socioeconomic status on PISA results could be weakened, for Italy as a whole, by the fact that the distribution of Italian results is shifted towards the bottom. Rather than a lower degree of inequality, one might call it a higher

[3] Basically, it is the value of the R-squared of the regression between status index and test scores. It measures the share of performance variations that can be traced back to differences in the socioeconomic status index. The remaining part must be traced back to other factors.

[4] All the table figures, partly already published in OECD reports and partly in individual national reports, have been recalculated for the occasion, following the same methodology and using PISA database on the OECD website, to make them fully comparable.

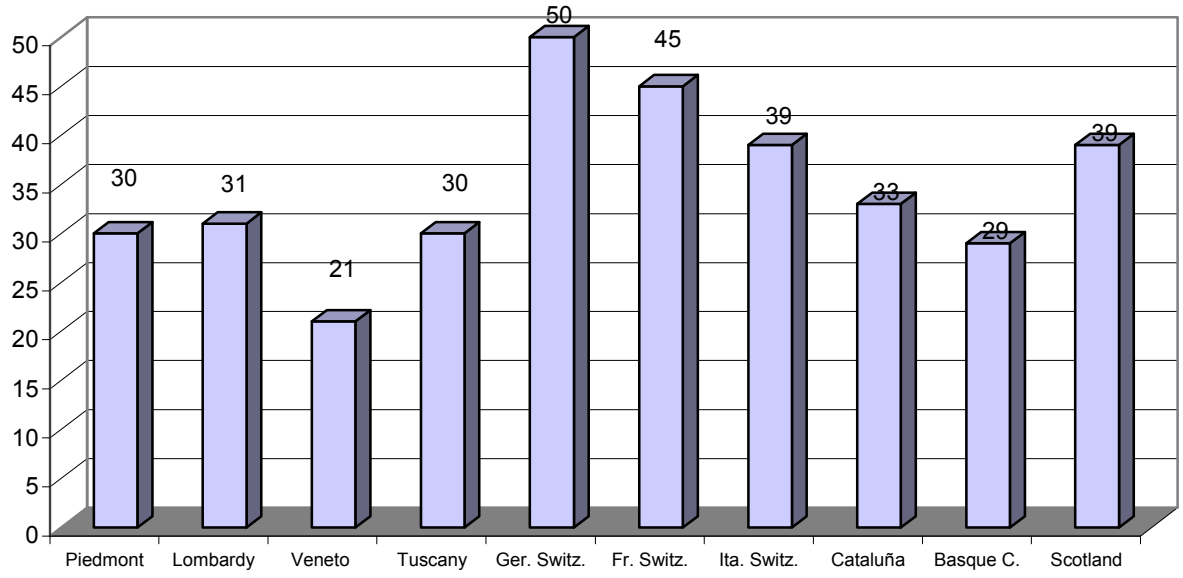
degree of flattening. However, in the regions of Northern Italy – where performances are definitely higher than the national average and in line with international standards – data show that the impact of socioeconomic status is even lower than the Italian average, and much lower as against the other European regions compared in the study. At least in the regions of Northern Italy therefore, social inequalities seem to have a lower impact on performance and this does not seem to undermine the quality of average performance values. This is once again a significant insight that would have been impossible to gather from aggregate national data.

A confirmation of these somehow astonishing findings may come from another way of looking at the strength of the relation between socioeconomic and cultural status and PISA test results. Following the example of OECD reports, one might measure the extent to which students' performance is likely to change with an increase of one unit in the ESCS summary index[5]. In general, in the average of OECD countries, this variation equals 45 points in the maths scale, and it may be considered a measure of the average sensitivity of PISA results to status variations.

The subsequent Graph offers a visual representation of the extent to which maths performance might be affected by socioeconomic and cultural background changes in some European regions. It clearly shows how much this influence may vary between different regions, even within the same country.

[5] In this case, we focussed on regression coefficients to describe the direction and the magnitude of variations induced in the dependent variable (PISA results) by an increase of one unit in the value of the independent variable (the socioeconomic and cultural status index).

Chart 7: Variation of Maths Scores Correlated to a One-unit Increase in Family Socioeconomic and Cultural Status on a Regional Basis



Source : PISA/OECD database – processed by IRES Piemonte, 2005

Again, Veneto is the region where family background shows the lowest impact on maths scores. In this region a one-unit increment in the socioeconomic status index is matched by an increase of only 21 points in the PISA scale. In Piedmont, Lombardy and Tuscany the same increase corresponds to 30 points, which is only slightly less than the national average of 34, and pretty similar to the values of the Basque Country and Cataluña.
Conversely, the performance of German and French-speaking students in Switzerland seems to be more sensitive to changes in socioeconomic and cultural status, with respectively 50 and 45 point increases matching each unit increment in the status index: a sensitivity higher than in Scotland and in the Italian-speaking area of Switzerland (39).

In summary, in Northern Italian regions, unlike other Italian areas, the skills of 15-year old students are not inferior to the ones measured in other comparable European regions. Furthermore, a closer look highlights that the influence on PISA performance commonly attributed to social background seems to be definitely less powerful in these regions or, at least, be adequately counterbalanced by other influences capable of reducing social differences without lowering average performance. Thus, at least in a relevant part of Italy, quality and equality in educational outcomes seem to go hand in hand. As an additional challenge to deeply rooted views, attention should be devoted to the emblematic case of

Veneto, a region where the level of skills was among the highest in absolute terms and spread out rather evenly regardless of the different types of school specialization considered and of differences in the socioeconomic and cultural status of students.

Clearly, this observation is intended to be a further incentive to deepen the scope of studies and go beyond a merely descriptive approach, rather than being an exhaustive explanation of the results obtained so far. However, at the end of this exploration, at least one provocative question may be raised: after all, taking a closer look at PISA data from the Italian perspective, couldn't we find a sort of "Finland" of our own in the apparently poor landscape of Italian average performance? If so, such a model would be felt closer to our reality than the one celebrated in PISA reports: it could therefore be more easily emulated by other Italian regions.

2. WHICH ARE THE FACTORS MORE RELATED TO PISA RESULTS? DIFFERENCES AND SIMILARITIES BETWEEN SOME ITALIAN REGIONS: A MULTILEVEL ANALYSIS.

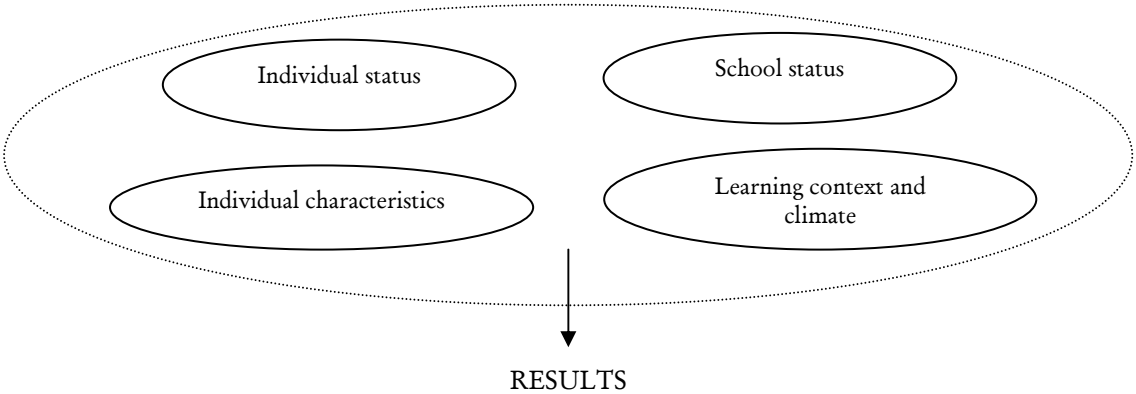
2.1. The goal of the analysis

Which variables, both individual and related to the learning environment, show the highest statistical impact on PISA test results? And therefore, which are the most appropriate conditions, both for individuals and learning contexts, to be favoured by families and educational institutions? Which policies should be adopted?

A first attempt to give an answer to these questions was based on the comparison of PISA test results with data about the socio-cultural and economic background of students. This analysis showed that, at least in the Italian regions considered, socio-economic status reveals only a limited impact on the scattering of maths test results: even more limited than the Italian average, where variance explained by social status is lower than the OECD average.

Following this observation, an attempt was made to identify other variables which could explain the difference observed between and amongst the various regional areas. The individual and his/her educational learning context, i.e. the school attended by the student, are the analytical units adopted by the study.

The analysis includes both an explanatory variable related to the socio-economic and cultural status of the individuals and a similar variable concerning the schools attended. These two variables are then supplemented by some others related, on the one hand, to the characteristics of the learning context and climate and, on the other, by individual attributes and skills.



2.2. Multilevel analysis

Multilevel Analysis is the method adopted in the study to carry out a statistical analysis of the relations between a dependent variable (Maths test scores in PISA) and a number of independent variables at different levels, in this case at individual and school level.

It is thus possible to identify the share of score variability that can be attributed to each factor, "cleaned" from the influence of all the others.

Here are the explanatory variables included in the model:

- at individual level:
  - o family socio-economic and cultural status;
  - o gender;
  - o grade;
  - o confidence in ICT routine tasks;
- at school level:
  - o the average socio-economic and cultural status of the school;
  - o study programme;
  - o school size (the overall number of students);
  - o the territorial location of the school (number of inhabitants in the town where the school is located);
  - o students' behaviour (incorrect behaviours such as absenteeism, vandalism, bullying, which may undermine learning, according to the school managers)
  - o disciplinary climate during maths classes, according to the students.

The selection of variables was based on their significance in the stepwise regression of maths scores. Stepwise regression was carried out on a representative sample of each of the four Italian regions included in the PISA survey.

Correlations between variables were subsequently analysed to identify possible overlapping in the effecst of the factors involved.

None of the relations shows high correlation values, except between the school average socio-economic and cultural status index of the school and the "Lyceum" type of upper secondary school.

Table 3: Table of Correlations between Selected Variables

Correlations (ρ by Pearson)	Individual ESCS	Confidence in ICT tasks	Gender	Grade	School ESCS	Lyceum	Voc. Schools	Total Number of Students	School Location	Students' Behaviour	Disciplinary climate
Individual ESCS	1	0.19	-0.04	-0.17	0.52	0.38	-0.26	0.00	0.11	0.18	0.28
Confidence in ICT tasks	0.19	1	-0.15	-0.10	0.12	0.01	-0.16	0.00	-0.05	0.07	0.07
Gender	0.04	-0.15	1	-0.10	0.07	0.26	-0.04	-0.03	0.14	0.23	0.19
Grade	0.17	-0.10	-0.10	1	-0.23	-0.22	0.15	-0.06	0.02	-0.09	-0.19
School ESCS	0.52	0.12	0.07	-0.23	1	**0.71**	-0.50	0.00	0.21	0.34	0.54
Lyceum	0.38	0.01	0.26	-0.22	**0.71**	1	-0.43	0.03	0.27	0.33	0.61
Vocational School	0.26	-0.16	-0.04	0.15	-0.50	-0.43	1	-0.11	0.16	-0.39	-0.43
Total Number of Students	0.00	0.00	-0.03	-0.06	0.00	0.03	-0.11	1	0.24	-0.10	-0.01
School Location	0.11	-0.05	0.14	0.02	0.21	0.27	0.16	0.24	1	-0.01	0.04
Students' behaviour	0.18	0.07	0.23	-0.09	0.34	0.33	-0.39	-0.10	-0.01	1	0.33
Disciplinary climate	0.28	0.07	0.19	-0.19	0.54	0.61	-0.43	-0.01	0.04	0.33	1

Source: PISA/OECD database processed by IRES Piemonte, 2005

The subsequent step in the statistical analysis of maths performance of students in Piedmont, Veneto, Lombardy and Tuscany was the development and assessment of seven multilevel models in each region.

2.3. Key considerations about variable selection

The selection of variables tested on the Piedmont sample, followed two criteria, a methodological and a statistical/practical one.

The methodological criterion excluded ambiguous variables and those of difficult interpretation. One of them is the "Mathematics Self-Concept" variable, significant and "influential" by itself, but ambiguous. It is elicited from the following statements:

1. I'm no good at maths;

2. I get good marks in maths;
3. I learn maths very quickly;
4. I have always thought that maths is one of my favourite subjects;
5. During maths classes I can understand even the most difficult concepts.

In the interpretation of the relation between performance and self-confidence it is rather difficult to establish the direction of the causal relation and there is a dilemma: is it confidence that influences performance or is it instead good performance that generates a high level of self-confidence? The explanation of students' performance is still affected by this ambiguity.

The statistical/practical criterion has excluded variables often considered relevant in the learning process: if on the one side, they are statistically significant, on the other, they show limited explanatory power in terms of explained variance (maximum value 5%) and, sometimes, their relation with performance goes in a direction different from the one expected.

Table 6: Univariate Analysis between Maths Performance and Excluded Variables

VARIABLE	EFFECT
Time spent on the study of maths	LIMITED / NEGATIVE
Attitude towards school	LIMITED / NEGATIVE
Sense of belonging	LIMITED / NEGATIVE
Relationship with the teachers	LIMITED / NEGATIVE
% of maths teachers with a degree	LIMITED / POSITIVE
Learning strategy: Control	LIMITED / POSITIVE
Learning strategy: Elaboration	LIMITED / POSITIVE
Learning strategy: Memorisation	LIMITED / NEGATIVE

This is the case of the variables about the time devoted to study and the quality of interaction between students and teachers, which show a surprising but negative relation with the expected score.

The other variables confirm the expected trend of relations, but show a more moderate influence on performance, compared to what on could expect.

2.4. Linear hierarchical models

Table 4: Multilevel Model Variables for a Comparison between Regions

NAME	DESCRIPTION	TYPE	CODE
Dependent Variables			
PISA maths test results (5 p_value maths average)	Maths Score	Continuous	Math
Independent Variables			
Students Level:			
Individual Socio-economic and Cultural Status (ESCS)	Socio-economic and Cultural Status of the family of origin	Continuous	
Gender	Male or female gender	Categorical	1=FEMALE 0=MALE
Grade (year_sch)	School year	Categorical	1= Behind 0= Regular or ahead
ICT Confidence in routine tasks (routconf)	Mastery of PC skills in routine operations	Continuous	
School Level:			
Average socio-economic and cultural status (escs_m)	School socio-economic and cultural status	Continuous	Average school value attributed to each student
Study Programme (stdyprg 4)	Lyceum	Categorical	1=YES; 0=NO
Study Programme (stdyprg 3)	Vocational School	Categorical	1=SI; 0=NO
School size (schlsize)	Total number of students	Continuous	School value attributed to each student
School Location (scho_loc)	Territorial school location	Categorical	1= major centre (> 100.000 inhabitants) 0= minor centre (< 100.000 inhabitants)
Students' behaviour (studbeha)	Students' attitudes and behaviours which may undermine learning (according to school managers)	Continuous	School value attributed to each studen
Disciplinary climate (discli_m)	Discipline during maths lessons (according to the students)	Continuous	Average school value attributed to each student

Table 5 : Multilevel Model of PIEDMONT

INTERCEPT OR EXPECTED OUTCOME (MATH)	*495.01*	*516.18*	*514.53*	*516.54*	*505.31*	*523.28*	*509.88*
STUDENT'S LEVEL	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Individual socio-economic and cultural status (escs)		9.98	7.26	5.80	5.60	5.68	5.58
To belong to the female gender (gender)		-23.32	-18.16	-18.48	-19.31	-20.43	-20.98
To lag behind (sch_year))		-50.69	-47.48	-48.20	-47.40	-48.08	-47.41
ICT: Confidence in routine tasks (routconf)			16.85	17.22	17.11	17.15	17.02
SCHOOL LEVEL	(1)	(2)	(3)	(4)	(5)	(6)	(7)
School context characteristics							
Average Socio-economic and cultural status (escs_m)				58.19	32.10	34.63	24.38
School type: Lyceum (stdyprg4)					22.87		13.94*
School type: Vocational School (stduprg3)					-30.11		-24.07
School size (schlsize)					0.03		0.03
School location (scho_loc)					-19.77		-18.06
Practices and Climate							
Students' behaviour (studbeha)						8.98	7.09*
Disciplinary climate in the class (discli_m)						39.29	26.18
RANDOM ITEMS	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LEVEL 1 Variance	4023.95	3579.13	3361.12	3365.74	3357.64	3366.06	3359.81
LEVEL 2 Variance	2474.85	1720.17	1587.88	772.82	376.08	547.12	276.94
Variance proportion attributed to schools (ρ)	38.08%						
Proportion of explained variance between schools		30.49%	35.84%	67.77%	84.80%	77.89%	88.81%
Proportion of explained variance within schools		11.05%	16.47%	16.35%	16.56%	16.35%	16.50%

* not significant

The first model is called "*empty*". It does not include any explanatory variable and performance variability can be broken down into two components: within schools and between schools. Subsequent models introduce individual variables (models 2 and 3) and school variables (from model 4 to model 7).

The last model, called "saturated", includes all the variables considered in previous models. These variables play a role in explaining performance variability in mathematics between schools and within schools. Please consider that an increase or drop (in the case of negative coefficients) in maths scores due to a variation in the value of explanatory variables in the model should be considered in comparison with the average performance, indicated by the expected intercept outcome. It identifies a "standard" student with individual and school characteristics corresponding, in the case of categorical variables, to the condition defined as "0" (male, attending the year group in line with his age or ahead, attending a Technical School located in a minor urban centre). In the case of continuous variables instead, it corresponds to the regional or school average (mean individual socio-economic status, medium-sized school, etc.) The choice of the variables values used to define a "standard" student was suggested by two criteria: they appeared more frequently in the sample and allowed for the identification of expected variations in the profile of an "average" subject when his/her personal and school characteristics vary.

2.5. The Piedmont model: outcomes

The first model, the aim of which was to assess the share of performance variability attributable to the individual on the one hand and to the school on the other, highlighted that the weight of schools on performance variance among students was equal to 38%. This means that most differences observed in performance, namely 62%, depend on individuals rather than on school discrepancies.

Subsequent models show what percentage of variance between schools (38% of total variance) and within schools (62% of total variance) can be explained by the variables included in the study. For instance, model 2 explains 30% of variance attributed to schools and 11% of variance attributed to individuals; model 7 instead explains almost the entire variance between schools (it explains 89% out of 38%) but only 16.5% of variance between individuals.

The second model begins include student-level variables like the socio-economic and cultural status of the family of origin, gender and grade.
All the three variables considered are significant, though their impact on score variations may be different:

- an increase of one unit in the value of socio-economic and cultural status indicator shows a positive influence on the math score, though to a limited extent (up to 10 additional points);
- female gender has a negative influence: female students suffer from a gap of 23 points as against male students;
- lagging behind has a strongly negative influence, indeed expected student's performance, in case of repeated grade, drops by over 50 points.

The third model completes "student" level analysis with a variable on skills not strictly related to school, i.e confidence in the basic use of information technologies. In stepwise regression the latter turned out to be one of the most significant variables starting from the second model.
The inclusion of this variable moderates the effects of both socio-economic and cultural status (which is now responsible for a 7 point increase as against the previous 10) and of gender, with a five-point reduction of the male-female gap. A unit increase in the ICT confidence index contributes to a 17-point increase in maths expected scores, both in this model and in subsequent ones, no matter whether new variables are added. This result may be particularly important if we consider that through this factor we can assess skills usually not taught at school and which derive instead from experience gathered in other contexts, be it a playing context or the use of information technologies for personal reasons. The very fact that confidence in the use of ICT tools improves expected performance in maths may indeed confirm the role played by skills acquired in daily life experiences.
The fourth model begins to explore the "school" level with a variable related to the average socio-economic and cultural status of school. The introduction of this variable has led to a considerable shift upwards in explained variance between schools, from 36% to 68%.

Furthermore, a unit increase of this variable raises maths expected scores by 58 points, leaving the effect of individual level variables almost unchanged (except for socio-economic and cultural status which loses one point).

It appears therefore that socio-economic and cultural status, though playing a limited role at individual level, plays a much greater role when related to the school. This strong and persistent influence still asks to be explained in causal terms, looking first for mechanisms leading to unequal aggregation of students with different backgrounds in different schools, also within the same study programme.

If we observe model 5, which incorporates further aspects of the school environment, we can see that a part of the effect attributed to the school average socio-economic and cultural status is absorbed by the type of study programme chosen by students. More specifically, if a student with the same socio-economic characteristics of the average of those attending Technical School attends Lyceum instead, his/her score in maths is expected to be 23 points higher; if he/she attends Vocational School, his/her score is likely to be lower of about 23 points. Nonetheless the weight of the school socio-economic status remains high and significant even after losing part of its impact to the benefit of the type of school.

The variables describing school size and territorial context are both significant and diverse in their effects. The former has basically no discriminating influence,– there are no consistent differences between small and large schools – the latter has a negative effect on performance when the school is located in a larger urban area.

The sixth model features the last two variables selected from the stepwise regression analysis on school characteristics and climate: students' behaviour and disciplinary climate in the classroom during maths lessons. Both variables share the same outcome: correct behaviour by students and a good disciplinary climate have a positive influence on performance.

Interestingly, disciplinary climate during the lessons according to the students is one of the most influential factor: a unit increase in the relevant index increases performance by 39 points.

In model 7, the complete one including all the dimensions considered, the influence of individual variables do not show considerable variations. Among school level variables, instead, the following are observed:

- a lower influence of the school socio-economic and cultural status, of its territorial location and disciplinary climate (which remains high anyway);
- a reduced significance of the "Lyceum study programme type": (which can be partly attributed to the correlation of this variable with the average socio-economic and cultural school status), and of the "Students' behaviour".

Summarizing, the first model (the empty model) was useful to identify the proportion of variance attributed to schools and students and to outline two levels of explanations for performance differences.
Subsequent models, introducing variables related to students, context and learning climate, specify the impact of each variable on performance variance, one separate from the others. School level variability, accounting for 38% of total variance, is almost completely explained: in the saturated model the percentage of explained variance among schools is 89%. At student level instead, selected variables account for about 17% of variance, leaving a wide margin of variation that cannot be explained by collected data.
Differences in the performance of Piedmontese students have been mostly explained at an aggregate level: learning context and climate are important factors, in explaining the variability of results.
Variables related to personal skills, not always acquired in the school system, for example the ability to use information and communication technologies, might be the subject of a more in-depth analysis to explain the diverse skill range of individuals, so far insufficiently specified by the model (and by PISA data).
In particular, the high impact of these skills on students' performance may point to a possible direction in the policies aimed at reducing unequal opportunities among individuals. The suggestion, in this case, is about promoting access to information technologies, making them more easily available than what is usually the case in educational institutions or making it easier for families to acquire them.

2.6. Regional models: Comparison of variance components

The following three tables make it possible to compare variance components among regions. The seven models applied to Piedmont were equally applied to Veneto, Lombardy and Tuscany.

Table 7: A Comparison of Variance Components: between and within schools

EMPTY MODEL	VAR BETWEEN	VAR WITHIN
Piedmont	38.08	61.92
Veneto	37.76	62.24
Lombardy	46.10	53.9
Tuscany	43.74	56.26

Table 8: Variance Percentage Explained by Average School Socio-economic and Cultural Status

MODEL 4	% VAR BETWEEN EXPLAINED	% VAR WITHIN EXPLAINED
Piedmont	67.77	16.35
Veneto	50.49	10.52
Lombardy	73.13	13.18
Tuscany	76.16	16.81

Table 9: Variance Percentage Explained by the Saturated Model

SATURATED MODEL	% VAR BETWEEN EXPLAINED	% VAR WITHIN EXPLAINED
Piedmont	88.81	16.50
Veneto	74.27	10.53
Lombardy	84.68	13.18
Tuscany	91.66	17.19

Source: PISA/OECD Database – processed by IRES Piemonte, 2005

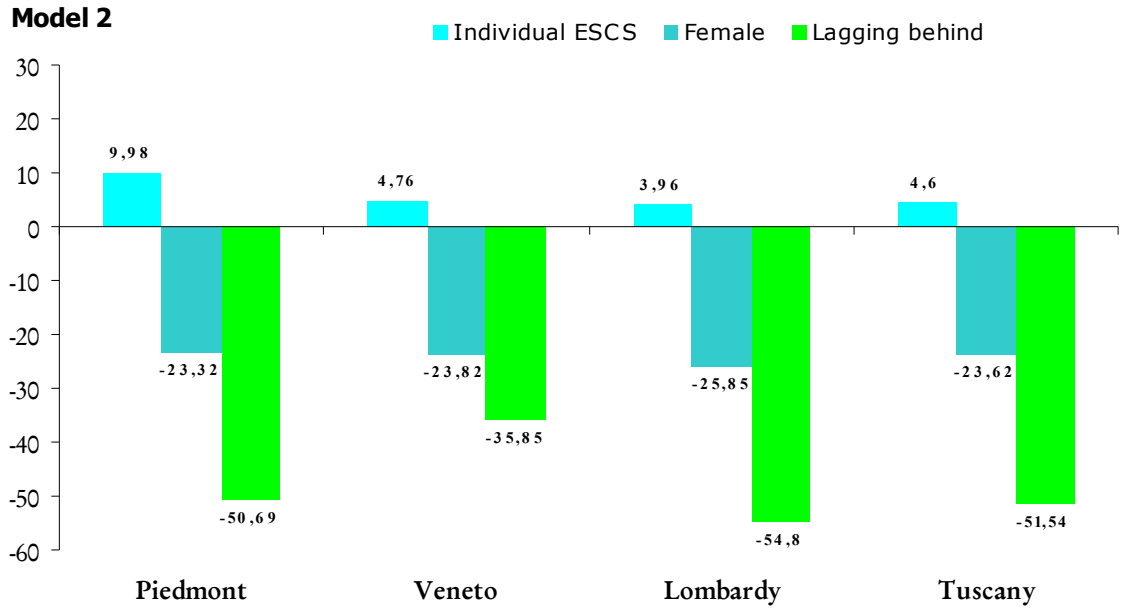
Table 7 shows the percentage of variance between schools and between individuals stemming from the empty model, while tables 8 and 9 show the percentage of these two components of variance explained by two different models. Model 4 is the first one introducing a variable related to the school level – the school average socio-economic and cultural status. In any of the regions considered the percentage of explained variance among schools is higher than 50%, and it is 76% for Tuscany. Through the saturated model we can observe that, in the four regions, differences between schools have been mostly explained and that learning context and climate are key factors in accounting for variance among schools. Of the variance among individuals in the four regions, however, only from 10 to 17% can be explained, confirming that selected variables only show a relative influence on performance differences within schools.

2.6.1. A comparison of regional models: the student level

In model 2 the effects of individual variables point to the same direction in all the regions involved in the study. Individual socio-economic and cultural status play an even smaller role in the regions compared with Piedmont.

Gender confirms the influence showed in Piedmont: being female reduces the expected value by 24 points. Regularity in following the path of study programmes also points in the same direction: lagging behind leads to a considerable drop in the expected outcomes.

Chart 8: Inter-regional Comparison of Student-level Variables



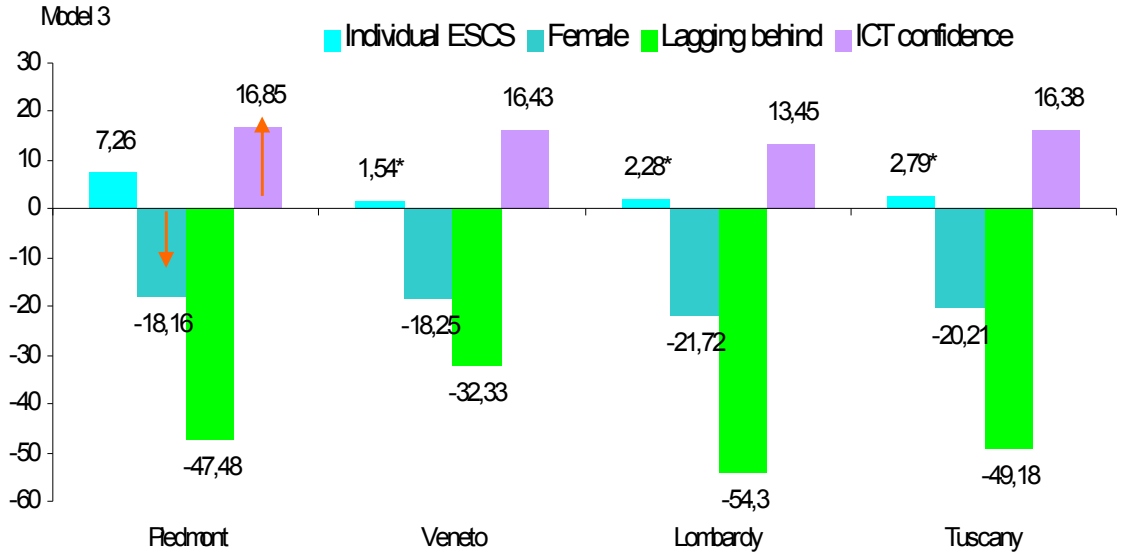
Source: PISA/OECD Database – processed by IRES Piemonte, 2005

We can clearly notice a smaller drop in Veneto, compared to the other regions: Veneto schools seem able to contain the gap between students regularly following their study programme and those who lag behind.

Model 3 introduces the variable representing confidence in the use of information and communication technologies. The observation of models and regions suggests that this variable tends to mitigate gender differences with effects of comparable weight and opposite direction. Moreover, this is the only variable consistently maintaining its influence on score variations in all the models of the four regions. The stability of this factor and its effects on gender differences suggests that an increased use of these technologies, especially within the

educational system, might contribute to enhance and balance the competencies and skills of male and female students.

Chart 9: Inter-regional Comparison of ICT Use and Gender

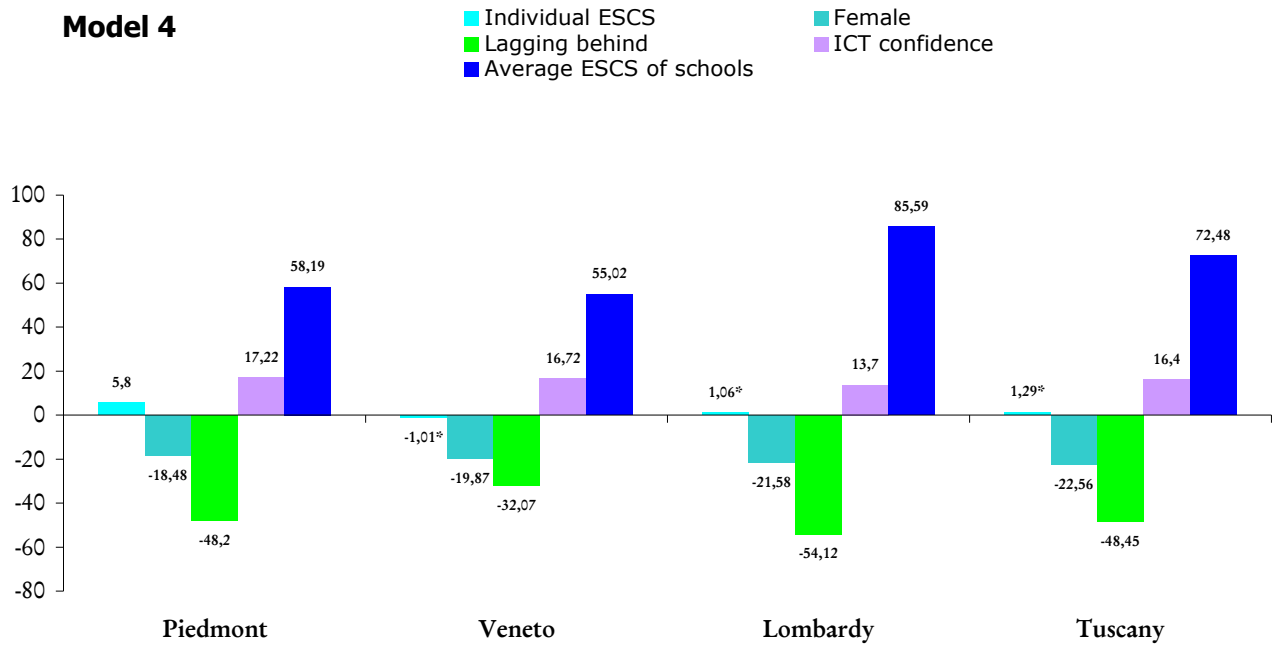


Source: PISA/OECD Database – processed by IRES Piemonte, 2005

2.6.2. Comparison of regional models: the school level

An interesting comparison at the school level is that of average school socio-economic and cultural status. As we previously saw, the introduction of this variable remarkably increases the percentage of explained variance among schools. In all regions the effect of a unit increase in the school average status is reflected in a several point rise in maths average performance: from 55 points in Veneto, where the introduction of this variable allows the model to explain up to 50% of variance between schools, to 86 points in Lombardy where it explains over 70%.

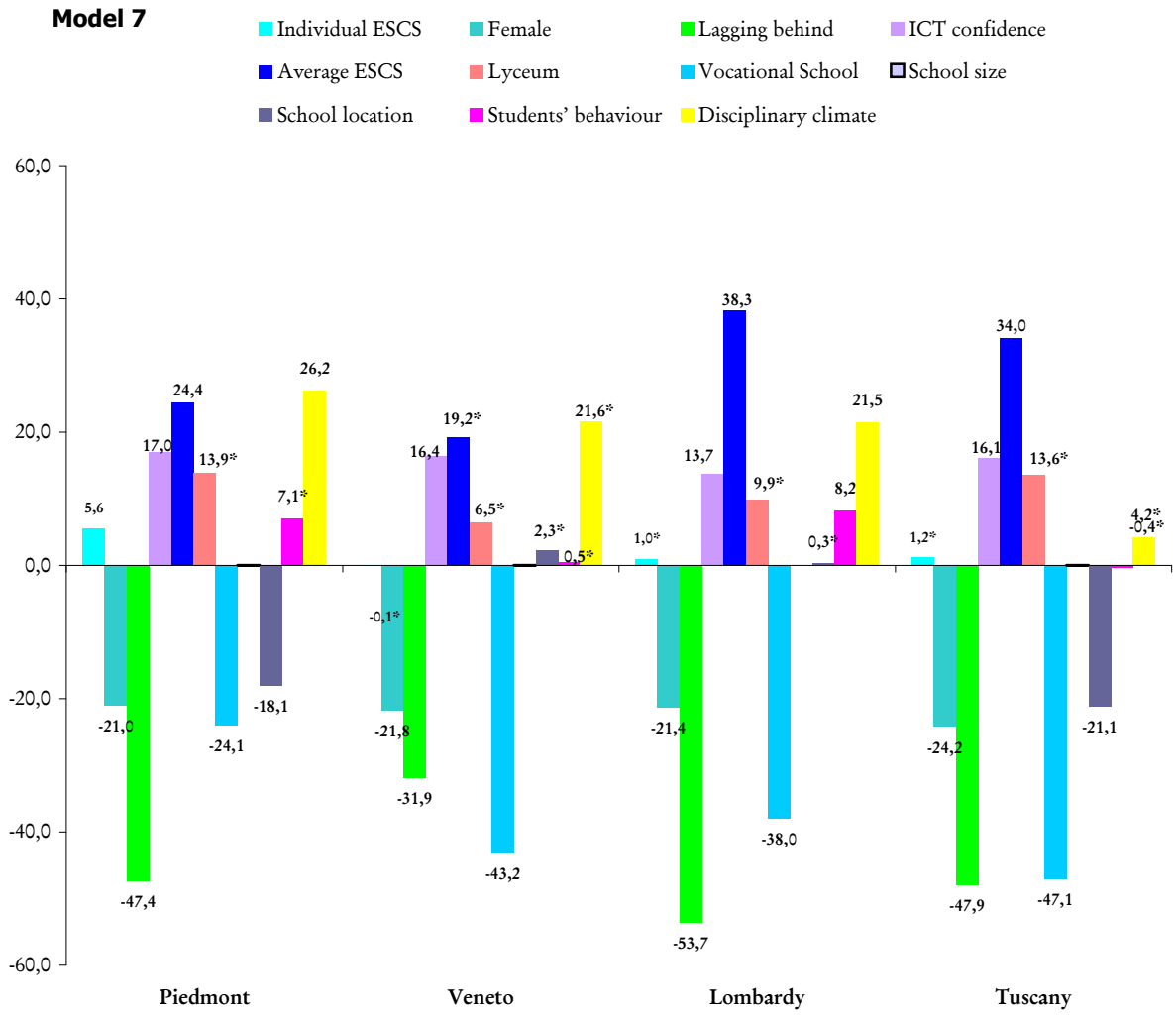
Chart 10: Inter-regional Comparison of Average Socio-Economic and Cultural Status (and other variables) relations with individual performance in maths



Source: PISA/OECD Database – processed by IRES Piemonte, 2005

We can now finally comment on the saturated model, which includes all the variables of the previous models.

Chart 11: Inter-regional Comparison based on the Saturated Model (individual and school level variables)



Source: PISA/OECD Database – processed by IRES Piemonte, 2005

Individual socio-economic and cultural status shows limited and non-significant effects, while being female entails a lower score in all the regions, even if this effect is mitigated by the variable on confidence in new information and communication technologies.

Two different trends emerge with respect to average school status: in Piedmont and Veneto school status differences imply a more moderate score variation among students (which is even not significant in Veneto); in Lombardy and Tuscany the variation is more substantial, almost twice as much as that of the two previous regions. Territorial differences, from this point of view, seem to be a deserving object of investigation.

Attending Lyceum rather than Technical School has positive but not significant relation, while attending Vocational School is associated with a strong reduction of the scores. This confirms that support should be focused mostly on these students, who probably chose this study program because of their weaknesses in academic learning.
The size of the school results irrelevant: one explanation might be that in the Italian sample of schools the number of students ranges from a few hundreds to a thousand, while in countries like the USA there are more sizeable variations which help better highlight the influence of size on performance.
School location plays a role too but not in the same way everywhere: in Piedmont and Tuscany attending a school in a town with over 100.000 inhabitants shows a negative relation with the score, whereas the effect is neither significant in Veneto nor in Lombardy.
Students' behaviour has positive and significant relations in Piedmont and Lombardy, while it has no relation whatsoever in Veneto and Tuscany. Disciplinary climate during maths classes has positive and rather considerable relations on performance in all the regions, except Tuscany.

2.7. Conclusions

The variables selected and included in the seven multilevel models applied to the region of Piedmont have shown interesting results, even when applied to the three other regions of Central and Northern Italy. They often confirmed both the strength of the association between individual factors and PISA scores and the statistical significance of the same relations between variables.
In the light of inter-regional comparisons, which variables can be considered more relevant to both understanding the outcomes and identifying possible areas where changes or innovations are still necessary?
Individual socio-economic and cultural background reveals a limited association with PISA results: even if a better status is associated with positive performance variations, the statistical relation turns out not to be significant in the three regions compared with Piedmont. Individual status of origin, in the light of PISA data, does not seem to be a factor with a particularly high-impact on students' skills and competencies.
Contrary to what happens at individual level, the variable with the highest impact, with positive and steady relation with maths performance, turned out to be the school average

socio-economic and cultural status. A unit increase in the school average status index associates with a remarkable rise in performance, even if moderated by the other context variables included in the various models. But this characteristic tends to be overlapping across different study programmes and the different levels of school skills usually associated to them. So if it is not easy to attribute precise causal meaning to the statistical relations emerging from the analysis. Nonetheless, it is a particularly interesting correlation worth further and more in-depth study.

A problematic area, emerging in all the regions examined, is that of gender association with PISA results: an issue common to all the countries participating in PISA. Which policies might be implemented to reduce the consistent disadvantage of girls in maths? Answers may be numerous and diverse. Our multilevel models point to a positive effect of ICT skills in mitigating gender differences in maths; this variable is the only one maintaining a consistent relation with score variations in all the models. The stability of this trend and its effect on gender differences suggest that an increased use of these technologies, especially in schools, could enhance and balance the skills and competencies of male and female students.

3. FOREIGN STUDENTS, FUTURE CITIZENS: A COMPARISON BETWEEN ITALIAN AND FOREIGN STUDENTS IN PIEDMONT

The aim of this study was to compare the Pisa skills of Italian students and of foreign students or children of foreign parents, with the opportunities offered by the family of origin and by the host educational system.

The decision to carry out a comparative analysis of learning levels of Italian and foreign students originates from the observation that in Piedmont, similarly to the rest of Italy, new generations include an increasing share of immigrant children, who are a key determinant in the re-definition of policies for reception, support and social integration into the receiving society and a challenge for the future.

The school, meant as a place for socialization, is an instrument to develop future citizens and society, as well as an observatory of the dynamics and trends that new generations will contribute to realize. It is also one of the domains where the presence of migrant minors is more visible, particularly in the eyes of residents (Inquiry Commission on Social Exclusion, 2003). Furthermore, the educational system can promote patterns of integration between people with different social, economic and cultural backgrounds, preventing the sheer homologation of the minority group into the majority one, to highlight instead the aptitudes and capabilities of every individual and make the best use of them. As shown by a number of studies on the subject carried out on the Asian population in America, successful integration at school and work for minors belonging to the various communities of migrants is also favourably influenced by the preservation of different cultural codes within the minority community, rather than the assimilation into the mainstream culture (Rumbaut 1997).

The destinies of Italian and foreign students are therefore shaped by a combination of individual and structural factors intertwined with family and cultural contexts. We shall now begin to identify some of these factors and to evaluate their relevance to the skills demonstrated by PISA students.

3.1. Performance and socio-economic and cultural Status

There is widespread consensus on the opinion that good performance at school is influenced by the socio-economic and cultural status of the family of origin. The

assumption is that it is mostly the environment where people live that has a strong influence on capabilities and expectations, on the choice of the study programme and therefore on students' performance. Following this line of reasoning, there should not be much difference between Italian and foreign students when they share the same socio-economic and cultural status, except for discrepancies caused by a poorer understanding and use of the language.

3.1.1. The Analytical Sample

A database with all the relevant variables has been created out of PISA data on Piedmont to test the validity of this assumption. The sample included gender, the student's country of birth and the following nine indicators: the highest occupational status of parents (HISEI), their highest educational level (HISCED), educational level of the mother (MISCED), educational level of the father (FISCED), immigration background (IMMIG), the student's expected educational level (SISCED), family socio-economic and cultural status (ESCS), a range of cultural goods owned by the family (HOMEPOSS) and the language most frequently spoken at home (LANG). These indicators were coupled with the scores obtained in the four fields of competence analysed by PISA (reading, maths, science and problem-solving), the type of school attended and the school mark in maths obtained by students.

For the sake of data reliability, all the sections of the samples with missing data were excluded from the analysis.

The composition of the sample reflects the population of fifteen-year old students in Piedmont: Italian students account for 96% of the total number and foreigners for the remaining 4%, as you can see from Table 10.

Table 10: Italian and Foreign Students by Gender in the PISA sample in Piedmont

GENDER	ITALIAN	FOREIGN	TOTAL
Male	12.405	592	12.997
Female	14.306	625	14.931
Total	26.711	1.217	27.928
Total %	95.6	4.4	100

Source: PISA/OECD Database – processed by IRES Piemonte, 2005

The Italian students of the PISA sample are almost divided by half between students belonging to a high socio-economic and cultural status (they are 51%) and students belonging to a modest one (49%). Among foreign students instead, the majority belongs to a modest status (71% of the total, but 77% of males) and only 29% come from a rich socio-economic and cultural context[6]. This difference should be interpreted within the analytical context rather than being seen as an absolute value: in the migration context, for instance, some of the variables considered relevant to a rich socio-economic and cultural indicator (for example the parent's job, the possession of books and of an adequate space for studying) might be underestimated as against the context of origin. If, instead, other questions had been asked, for example about the knowledge of one or more foreign languages (this variable is included in the database), or about the size of one's home in the country of origin, or the current or past job of parents in the country of origin, results might have been different. If we confined ourselves to consider the parents' educational level only, results would be even more different: the parents of migrant students, both father and mother, have higher educational levels in a larger percentage. The mothers and fathers of Italian students usually possess a lower secondary or a high school certificate while among foreign parents there is a higher percentage of qualifications from school graduation upwards, with a big edge on Italian parents, as shown in Table 11.

Table 11: The Highest Educational Qualification of the Parents' Couple based on Origin

ORIGIN	PARENTS' EDUCATION						TOTAL
	None	Primary School	Lower Sec.	Upper Sec.	High School	Univ. Degree	
Foreigners	3.3%	4.7%	8.4%		51.8%	31.9%	100.0%
Italians	0.1%	2.0%	22.3%	5.1%	49.5%	21.0%	100.0%
Total	0.2%	2.1%	21.7%	4.9%	49.7%	21.5%	100.0%

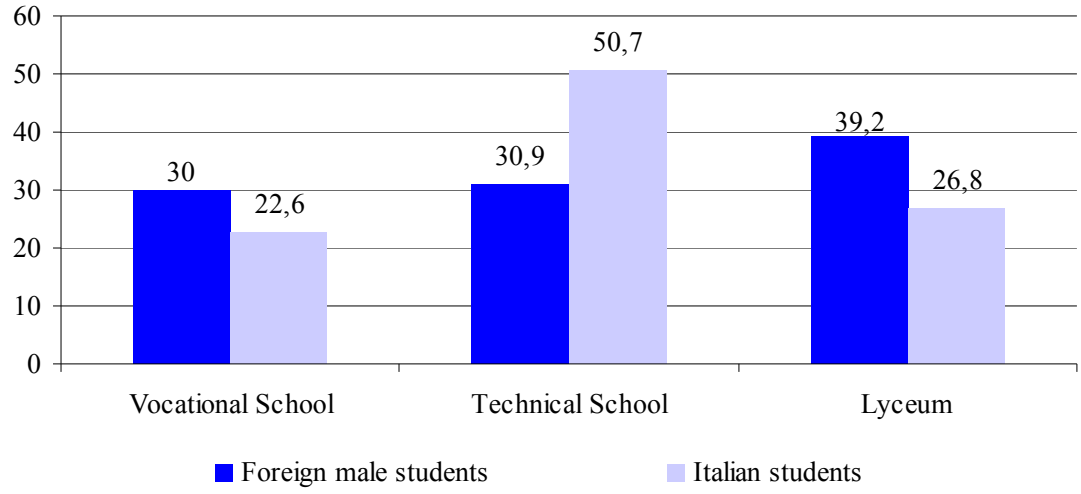
Source: PISA/OECD Database – processed by IRES Piemonte, 2005

[6] For an easier interpretation of data students were attributed a high or modest context by recoding the socio-economic and cultural indicator into two levels: "modest" and "high", despite the clear limitations of this choice. Since the distribution of the indicator follows a normal curve, a modest level includes those below average, while a high level includes those who are above average.

Relative poverty is therefore highlighted by the analytical context and the selected operational definitions.

We shall now analyse students based on the study programme chosen in upper secondary education. Some fifteen-year olds still attend lower secondary, when it is deemed necessary for them to repeat the year (it is the case for 0.9% of Italians and 25.8% of foreign students), while most of them attend upper secondary school. The high percentage of foreign fifteen-year old students still in lower secondary can be explained by the fact that they are often enrolled during the year, and they are either assigned to their corresponding grade and then made to repeat the year or they may be assigned to a previous grade, despite their age.
For the purpose of our analysis, upper secondary education has been subdivided into Vocational Schools, Technical Schools and Lyceums.

Chart 12: Percentage Distribution of Males by Citizenship and Type of Upper Secondary School



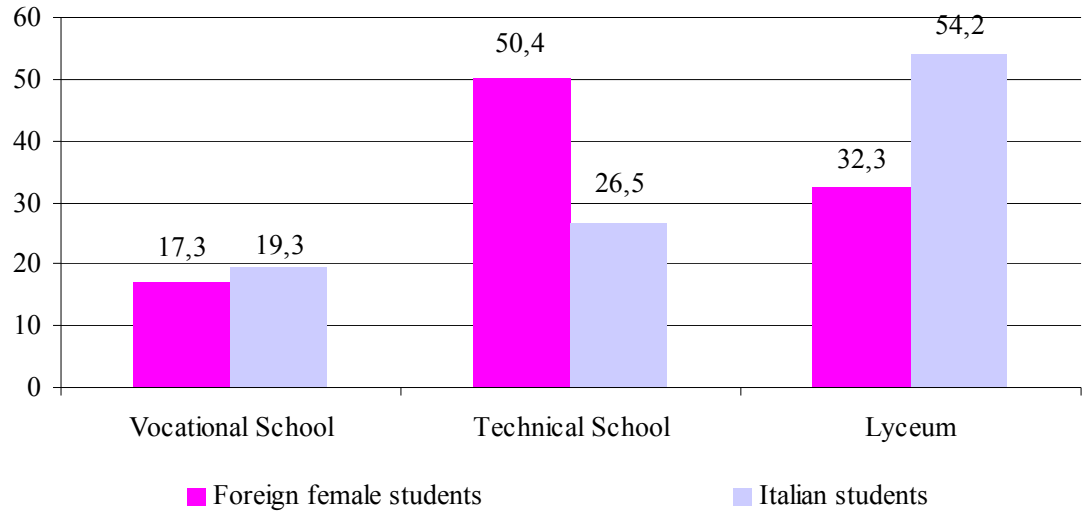
Source: PISA/OECD Database – IRES Piemonte, 2005

Male foreign students (excluding those still in lower secondary school) are rather equally spread among the various types of schools: almost 40% attend Lyceum, 30% attend Technical School and another 30% Vocational School. Conversely, 50% of Italian students go to Technical School, with the remaining 50% spread between Lyceums and Vocational Schools.

The distribution of female students, both Italian and foreign, is a very different one. Foreign female students are mainly concentrated in Technical Schools, 50%, while 30% of

girls choose Lyceum. The majority of Italian female students attend Lyceum, with its various streams of study (54%).

Chart 13: Percentage Distribution of Females by Citizenship and Type of Upper Secondary School



Source: PISA/OECD Database – IRES Piemonte, 2005

If we associate school type chosen and socio-economic and cultural context, modest or high, we notice a relative similarity between Italian and foreign students. The majority of students belonging to a high context choose to attend a Lyceum (60% of foreigners and 54.2% of Italians); the prevailing choice among those coming from a modest socio-economic and cultural context is Technical School (50.1% among foreigners and 41.7% among Italians). There are two main divergences here: a higher share of Italians belonging to a modest socio-economic and cultural context choose a Lyceum (6 percentage points more as against foreign students in the same category) and a slightly higher percentage of foreign students belonging to a high context choose a Vocational School (13.3% of foreigners versus 11.3% of Italians).

3.2. First aggregate results

The aggregate comparison of foreign and Italian students highlights that immigrant students' performance tends to be worse on average and that their skills and competences are lower than those of Italians in all the areas surveyed by PISA.

Table 12: Performance Average in the Four Competence Areas by Origin

Competence Area	Average	
	Italians	Foreign
Maths	502	413
Reading	510	389
Science	531	414
Problem solving	504	444

Source: PISA/OECD Database – IRES Piemonte, 2005

Besides, in the framework of aggregate analysis, the family socio-economic and cultural status, defined by PISA socio-economic and cultural status, has a limited influence on our data. This is abundantly demonstrated in chapter 2.5: socio-economic and cultural status accounts for no more than 10.6% of variance in maths scores for Piedmontese students and 14% for Italians (OECD average 20.3%).

Table 13: Maths Average and Variance explained by Family Socio-economic and Cultural Status

	GEOGRAPHICAL AREA	INDEX AVERAGE	Explained VARIANCE %
ESCS INDEX			
	PIEDMONT	0.0	10.6
	ITALY	-0.1	13.6
	OECD	0.0	20.3

Source: PISA/OECD Database – IRES Piemonte, 2005

3.3. Performance of Italian and foreign students related to socio-economic and cultural status index

At this point the study reverts back to two separate samples of Italians and foreigners with the aim of checking the origin effect and observing the relation between socio-economic and cultural status and the performance of each of the two groups.

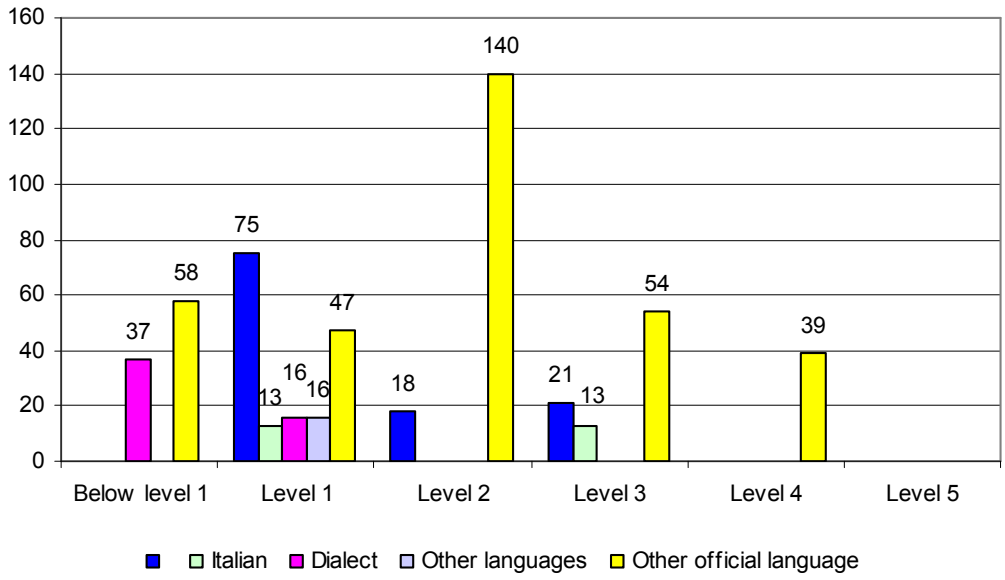
First gender has been associated to the impact of the socio-economic and cultural status index on performance, then the indicator has been broken down into its three components: the index related to the highest educational level obtained by the parents, according to the ISCED classification (International Standard Classification of Education), the index related

to the occupational status of parents (HISEI, Highest Occupational Level of Parents), the index of cultural goods possessed by the household (HOMEPOSS, Home Possession).
These measures show that among foreign students, socio-economic and cultural status explains a higher share of performance variance and pushes up the average, as against their Italian counterpart. Among Italian students, both males and females, socio-economic and cultural status explains 8% of variance on average; among foreign students this variable explains between 27% and 44% of variance in reading scores and a unit increase in the socio-economic and cultural level indicator enables them to add 93 points (males) and 57 (females) versus the general average (which is lower than the Italian one anyway).
Additionally, the component of socio-economic and cultural status identifying the level of education of the parents turns out to be more important than occupational status and possession of cultural goods in explaining the results of foreign students: a higher educational level of parents, is matched by a score increase of 42 points as against the male average and 16 points for females.

3.4. Maths and reading performance: What is the role played by the language spoken in the family?

The next variable selected to characterize students' cultural context is the language spoken at home. The language is indeed a means to describe and understand the world and its mastery is key to know one's way both at school and at work.
Interesting results emerge from a cross-analysis of spoken language and PISA performance levels in maths and reading.
As far as foreign males are concerned, those who reach higher PISA levels in reading are mainly those speaking a foreign language at home. The same applies to foreign female students: it is especially those speaking a foreign language at home who reach the highest performance in PISA (they account for 50% of the sample of foreign female students), while the majority of those speaking Italian (15% of the sample), only reach level 1.

Chart 14: Distribution of Foreign Females Across the Levels of the Competence Scale in Reading, by Language Spoken in the Family



Source: PISA/OECD Database – IRES Piemonte, 2005

Even in terms of their maths performance, it seems to be important for foreign students to speak a language other than Italian, except dialect. Those who speak Italian at home, males (35 students out of 592) or females (115 out of 625), can only reach up to level 2. Foreign students, males and females, who speak other languages with their relatives, English or another language of the European Union, reach better PISA levels.

An explanation of the fact that speaking Italian with the other family members does not help a foreigner reach better reading or maths competences, may be that the knowledge of a language should not be considered a mere study tool but, above all, a cultural endowment that enriches and broadens people's skills and possibilities. Along these lines, foreign boys and girls speaking a language different from Italian at home, seem to rely on an additional resource or incentive, helping them to achieve better performances. Following interesting distinctions emerged in the students' contexts, even though they are not always foreseeable, we might suggest to add this variable to the socio-economic and cultural status indicator.

3.5. Expectations

What do Italian and foreign students want to do? Which educational qualification do they aim at? Which variables affect their choices?

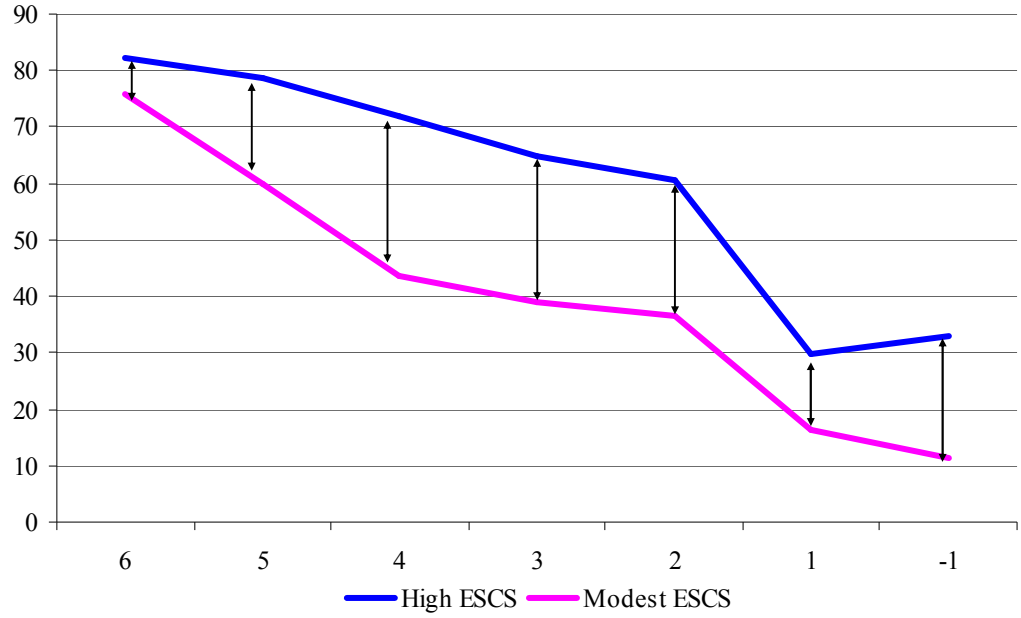
Data confirm that educational prospects differ according to the type of school they attend and to the results obtained in PISA tests.

If we consider the group of PISA top-performers and compare learning expectations and actual test results, we find that Lyceum students in the group say that they want to take a degree, both males and females, Italian and foreign. The highest percentage is observed among foreign girls: 100% of those attending Lyceum wish to continue their studies to become university graduates.

When we instead look at educational expectations based on the students' socio-economic and cultural status and PISA results (in maths and reading), we notice considerable differences in their behaviour according to their belonging to a high or modest socio-economic and cultural context. If, on the one hand, PISA top-performers want to take a university degree, as PISA performance levels start to diminish, there are fewer and fewer students who want to go to university and students from a modest context drop faster than those from a high one. So much so that among the latter, 60% of those who reach level 2 in the maths ranking, express the wish to take a university degree, while only 36.4% of those belonging to a modest socio-economic and cultural context share the same expectation.

A possible interpretation of this is that students are aware of the different opportunities deriving from their background: the cost of education (both the cost of university fees and missed income from a job) could be the main variable, based on which high-status students continue their studies while modest-status ones prefer to stop at school graduation and only the very best among them seek a university degree.

Chart 15: Differences in the Expectation of Graduating at University based on Maths Test Distribution among High or Modest Socio-economic and Cultural Status Students



Source: PISA/OECD Database – IRES Piemonte, 2005

The same analysis repeated with the variable related to origin versus performance and expectations shows that, on the one side, it is mostly Italian students who reach high PISA levels and want to continue their studies, and on the other, that foreigners with the same performance and expectations are females. The aspiration to go to university is also a sign of the degree of assimilation reached by girls, who certainly show a great desire to assert themselves through this ambition.

As we previously noticed, PISA test results and school performance are mainly associated to socio-economic and cultural context and the schools with a higher percentage of top-performers, Lyceums, are mainly attended by individuals from high cultural contexts (as shown before, this applies to a greater extent to foreigners). It can therefore be reasonably stated that even educational aspirations are affected by the socio-economic and cultural milieu.

3.6. Final considerations

In addition to highlighting existing differences between schools, the analysis of PISA data seems to suggest that the background of the family of origin, and not the student's nationality is the key factor for performance. This finding involves two further considerations:

- First, we are encouraged to take a sharper look at foreign students in Piedmont, at the heritage they carry with them, at the best way to receive them and to offer them the opportunity to express all their potential.
- Secondly, the comparison of the competences reached based on socio-economic and cultural status index offers a different perspective for the analysis of students' performance: the striking element is not so much the low levels reached by most foreigners, partly explained or justified by the language gap, but rather the low performance of a considerable part of Italian students. Support to language learning could therefore benefit both foreign students and the Italian ones who find it difficult to carry out analytical and processing operations, necessary in daily life.

BIBLIOGRAPHY

Bryk, A.S., Raudenbush, S.W. (1992), *Hierarchical Linear Model in Social and Behavioral Research: Application and Data Analysis Methods*, Sage publication, Beverly Hills.

Caritas (2004), *Immigrazione. Dossier Statistico 2004. XIV Rapporto,* IDOS, Roma.

Checchi (2000), *University education in Italy*, "International Journal of Manpower", vol. 21 n 3-4

Checchi, Zollino (2001), *Struttura del sistema scolastico e selezione sociale*, "Rivista di Politica Economica", 7-8/2001: 43-84 [also in Barca L., Franzini, M. (eds), *La cittadinanza difficile*, Editoriale il Ponte, 2001]

Commissione di Indagine sull'Esclusione Sociale (2003), *Rapporto sulle politiche contro la povertà e l'esclusione sociale*, Anno 2003, Ministero del Lavoro e delle Politiche sociali.-

Farley, R e Alba, R (2002), *The new second generation in the United States*, "International Migration Review", 36, 3

Goldstein, H. (1995), *Multilevel Statistical Models*, second edition, Edward Arnold, London.

Ministero dell'Istruzione (2005), *Indagine sugli esiti degli alunni con cittadinanza non italiana*, Roma.

OECD (2000), *Manual for the PISA 2000 database*, OEDC Publishing, Paris.

OECD (2004), *Learning for tomorrow's World-Fist. Results from PISA 2003,* OEDC Publishing, Paris.

OECD (2004), *PISA 2003 Valutazione dei quindicenni, quadro di riferimento: conoscenze e abilità in matematica, lettura , scienze e problem solving*. INValSI e Armando Editore, Roma.

OECD (2005), *PISA 2003 Data Analysis Manual*, SAS Users, OECD Publishing, Paris.

OECD (2005), *Technical Report 2003*. OECD Publishing, Paris.

Portes A. (2004), *For the second generation, one step at a time*, in T. Jacoby (eds.), *Reinventing the Melting Pot*, New York, Basic Books

Rak M., Lombardi C. (eds) (2002*), Osservatorio Permanente Europeo sulla Lettura,* (mimeo).

Rumbaut R. (1997), *Assimilation and its discontents: Between rhetoric and reality*, "International Migration Review", 31, 4

Snijders T.A.B., Bosker R.J. (1999), *Multilevel analysis: an introduction to basic and advanced multilevel modeling*, London, Saje