

School tracking and equality of opportunity in a multilevel perspective

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Abstract Recently, the Italian schools have been deeply influenced by the “social tracking” phenomenon, which translates into the existence of students segregations into socio-economic classes. Typically, this phenomenon is measured on the basis of the socio-economic heterogeneity between classes, through the employment of the Gini index. However, because of the usual hierarchical structure of educational data, a more suitable method for heterogeneity measurement is recognized in multilevel models. Our proposal is focused on comparing different multilevel models to explain how performances heterogeneity and socio-economic status effect are portioned out between school and classes, with regard to students of the Fifth Grade of Primary School in the Lombardy region. In particular, we show that the existence of a high variability between classes, conjoint to a significant socio-economic effect, confirms the presence of a social tracking factor.

Key words: Multilevel, social tracking, class heterogeneity, INVALSI data

1 Evaluation models in Education

Schooling systems present an obvious example of hierarchical structure, with pupils grouped within classes and schools, which themselves may be clustered within education authorities or boards. Educational researchers have been interested in comparing schools more often in terms of achievement of their pupils, with the aim of studying factors that explain school differences.

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To date, as noted by several authors ([4]), in many cases the study is based on the employment of two-level multilevel models. In educational contexts, all the existing analysis procedures are mainly devoted to provide an evaluation in terms of schools or an evaluation in terms of teachers. On the one hand, articles focusing on the former topic consider students nested in school, on the other hand, the ones focusing on the latter topic consider students nested in classrooms. Despite the large amount of evidence on the importance of both schools and classrooms on students' performances, there are few studies taking into account both class and school level. However, researches implementing a three level-structure discovered the existence of a greater variability between classes rather than between schools, as stated by [4]. This paper proposes to stress the relevance of considering variability between classes. Typically, variability between classes can be translated both in terms of teacher's and peer's effect. Indeed, there is a number of studies, as discussed in [4], according to which "how much a student learns depends on the identity of the classroom to which the student is assigned". In particular, peer effect can be interpreted in this context as the existence of a widely discussed sociological hypothesis ([2]), the so called social tracking factor. Our work investigates about this hypothesis in Lombardy Primary School through a suitable analysis of students' Math performances. The social tracking phenomenon contrasts with the "equality" principle, according to which the best practice is composing classes by maximizing the students' heterogeneity within classes and the students' homogeneity between classes. More in detail, social tracking factor is generated by the tendency of satisfying parents' pressure for the class choice. This feature contributes in segregation and classification of students into socio-economic classes, implying inequality in opportunities, as discussed by [1]. In this direction, our contribution is based on analyzing how variability is portioned out between classes and between schools. Furthermore, once detected the existence of a real variability within classes, our proposed research aim is based on the evaluation of the socio-economic status effect on class and school level through the multilevel models implementation.

2 The available dataset

In Italy the National Evaluation Committee (Invalsi - Istituto Nazionale per la Valutazione del Sistema di Istruzione e Formazione) has been established with the specific aim of evaluating the Italian schools. Invalsi carry out an analysis of students' achievement at different levels of education, second and fifth year of the primary school (age 7 and 10, respectively), first and third of the lower-secondary (age 11 and 13), second and fifth of the upper-secondary (age 15 and 18). The collection of such data started from the school year 2008/2009 and represents the first time that a law imposes a national evaluation by using standardized tests.

In this paper we focus on Math results relating to all students of the Fifth Grade of Primary School in the Lombardy region, for the school year 2009/10. The considered population is made up of about 82,000 students belonging to 900 schools.

3 Students' performances variability as a tracking factor effect

Aim of our contribution is to remark how multilevel models can provide interesting information about the existence of social tracking factor. Multilevel models allow to partition the variability of a specific phenomenon among the different involved levels, establishing in this way the heterogeneity within each considered level. This heterogeneity is measured by the intra-class correlation coefficient (ICC), that describes how much of outcomes variation is related to differences between units of each considered level ([3]). This aspect assumes a relevant role in our current proposed methodology framework, given our specific purpose of explaining the performances variability share referring to class and school levels. More precisely, we are interested in defining how such variability is partitioned when not all levels are taken into account. In order to achieve this goal, three different empty multilevel models have been run: a two-levels model characterized by school and students levels, a two-levels model characterized by class and students levels and a three-levels model characterized by school, class and students levels. Table 1 reports the empty models results in terms of variance decomposition and the intra-class correlation coefficient (ICC) value for all different levels.

Table 1 Variance decomposition with regard to the three implemented empty multilevel models - Fifth Grade of Primary School

	Two levels - School-Student		Two levels - Class-Student		Three levels - School-Class-Student	
	Variance	ICC (%)	Variance	ICC (%)	Variance	ICC (%)
Var. Between Schools	30	9.8	-	-	19	6.2
Var. Between Classes	-	-	50	16.7	32	10.7
Var. Within	273	90.2	250	83.3	250	83.1
Total Var.	303	100	300	100	301	100

With regard to Table 1 results, in Primary School the well known prevalent performances variability depends on students' characteristics. The most interesting outcome is related to the three-levels model which highlights as the variability between classes is greater than variability between schools, according to the evidence gathered from several studies ([4]). In particular, the former is almost double with respect to the latter. As explained above, our interest lies in establishing how much variability is partitioned in both the considered two-levels models with respect to that of the three-levels one. If one considers the two-levels model, characterized by only class and student levels, the between class variance gathers up both school and class variance resulting in the three multilevel model. Conversely, when the class level is not considered there is a clear growth of both variance between and within schools. In this case, the between class variance associated to the three-levels model is portioned out among the between and within schools variance of the two-levels model with only schools and students taken into account. Thus, a two-levels model is not

appropriate in describing the correct decomposition of variance and consequently in supporting an adequate school evaluation.

In such a context, some further considerations are needed. Usually, variability between classes is explained by the presence of classes with different grades and different teachers. Despite we expect a low variability between classes when only a grade is considered, we find a high percentage of this variability equal to more than 10% of the total one. Furthermore, variability between classes can be interpreted not only as grade and teacher effects, but also as peer effect. We investigate this last topic through the analysis of the ESCS index¹ (*Economic, Social and Cultural Status Index*) ([2]).

In literature ([2]), to measure heterogeneity between classes one resorts to the Gini index of the ESCS measure proving that a value of 0.12 denotes a high variability. With regard to our data, the Gini index amounts to 0.088 implying the existence of a relevant variability between classes. Multilevel approaches are here employed in order to validate the Gini index conclusions. In fact, through the Gini heterogeneity index employment one evaluates the possible existence of the social tracking phenomenon only providing a descriptive information, without taking into account the complexity characterizing educational systems organized in school and class levels. For this reason, the ESCS variable has been considered in the proposed framework. Specifically, three multilevel models have been built by introducing as unique independent variable the ESCS index. When focusing on a model with two levels, the ESCS index results significant at both school and class levels. On the contrary, when a three-level model is implemented, the ESCS results without effect on the Math students' performances at school level, differently from the ESCS at class level that appears highly significant.

Given the centrality of the Italian education system, a lower performance variability between primary schools is an expected result. High variability between classes and high ESCS effect at class level suggest students tend to choose the class rather than the school as evidence of the tracking factor existence.

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¹ Recall that ESCS index is computed by INVALSI as a summary measure of the highest occupational status and educational level of parents and home educational resources.