# The influence of school size, principal characteristics and school management practices on educational performance: An efficiency analysis of Italian students attending middle schools

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## ARTICLE INFO

## ABSTRACT

The aim of the paper is to identify which among the aspects that relate to the composition of the student body, school (district) size, management practices and the school principals' own characteristics are associated with the performance of Italian students at grade 8, measured through standardised test scores in reading and mathematics. The analysis makes use of a student-level efficiency model, and several school level variables are included as explanators for efficiency scores. The results show that, especially for reading, the most influential variables relate to the composition of the student body, while the students' performance in mathematics is partly correlated with the management practices adopted by the school principal/head teacher. Schools and schooling can only explain a minor part of the variance in achievement scores, however, and the characteristics of the students themselves play the most significant role.

## 1. Introduction

Empirical analyses of disparity in the quality of education across and within schools is receiving increasing attention (see Refs. [28,33]. While there is ample evidence that the quality of schools differs, in terms of value-added, there is more uncertainty about the relevant stakeholders that can help to improve the quality of education. A substantial research effort has been directed towards gaining a better understanding of the potential role that schools play in improving students' learning outcomes.

In many countries, the management practices used by school principals are receiving considerable attention, since, over the last decades and with the introduction of new regulations, schools and principals/head teachers have become more autonomous in a number of fields, including having discretion over their own educational programmes, organising their own activities and introducing innovative teaching methods and initiatives. The resulting heterogeneity in management practices can potentially affect the differences between schools in terms of learning outcomes.

This paper is inserted into the literature that investigates the role that school features have in influencing test scores, in general, and management practices, in particular. In so doing, we follow previous studies where school efficiency is analysed, this being defined as the ability to transform inputs (resources) into outputs (test scores). Scores for European countries are estimated in many articles. However, to our best knowledge, there is no evidence concerning the influence of management practices on school efficiency, or whether management practices are correlated with school performance in general. The key purpose of this paper is to identify which aspects relating to schools, principals

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and school boards are to be acted upon through policies, initiatives and management practices to drive student efficiency. By "students' efficiency" we mean neither direct student performance at school, nor school efficiency, but an index representing the pupils' improvement during junior secondary school (as explained later, measured through improvements over time from test scores at grade 6 to those at grade 8). We deal explicitly with the following research question: *Which are the school level variables that are statistically associated with the efficiency scores computed at student level?*

We will focus on the Italian education system, where there is limited evidence concerning the efficiency of Italian schools (see for example [1,2,4]. The literature on Italian schools has explained the school effect primarily through *school body composition and school size*, since other kinds of information were not available. This limitation corroborates the importance and originality of our dataset: for the first time, we can access information about *managerial practices* and *characteristics of school principals*. This allows us to gain a more complete view of the aspects typical of Italian schools. The methodology used to collect this kind of data is also new, since for the first time the National Institute for the Evaluation of the Education System [36] has asked school principals directly - through questionnaires - for their point of view about their role, their duties, the performance of their school in different fields and so on. This means that we have (direct and indirect) information regarding all four main groups of school level variables mentioned above.

Beyond the dataset, the innovation of this work is in applying Data Envelopment Analysis (DEA) to compute the efficiency scores of Italian students, considering them as an index of the goodness/weakness of the students' learning. To the best of our knowledge, this is the first study that applies DEA at student level within the Italian context, since most studies use schools as the unit of analysis [23]. In a second step, that of analysing the impact of given variables on the efficiency scores, we look for aspects relating to the management of schools and/or school body composition that are associated with the efficiency of students. We, therefore, contribute to the literature on school management in two ways, by:

(i) Defining the efficiency of students and linking this with management practices, school size and school level characteristics. By applying an innovative dataset and a new method of collecting information through questionnaires sent to school principals, we have precise information on the various activities carried out by the principals;

(ii) Building consistent composite indicators for variables relating to the principals' management practices: we indicate how to summarise information into composite indicators, in an efficient way, in order to create several synthetic indexes relating to the schools' management practices.

To anticipate our main results, we will show that the students' scores for reading and mathematics are certainly influenced by different aspects that are connected to their school. Students' reading achievement is influenced strongly by the composition of the school body, the pupils' peers and the context in which they live. Scores in mathematics also depend on management practices. We will, additionally, confirm that there are striking differences in student learning across macro-areas: students in the South of Italy perform, on average, worse than their counterparts in the North (a result that is consistent with [5]).

It is worth taking into account the fact that this is not the first time that this kind of administrative data has been studied in Italy. [44,45]; apply multi-level linear models to analyse how the students' achievements depend on the characteristics of schools, classes and the students themselves. Our work is in stark contrast with these two previous works, for several reasons. First of all, the research question is different: in the previous two studies, the aim was principally to identify the associations between the characteristics of students and students' achievement, and with the effect of attending different schools and classes. Our aim, instead, is to analyse the associations between the numerous features belonging to schools and the students' efficiency. Later, the methodology will differ radically: while the two previous works were based on multi-level linear modelling, in this work, we have applied Data Envelopment Analysis. Lastly, respect to the previous two works, in this analysis, we have introduced a series of new variables collected by [36] that concern the management practices of schools and school principals and which are of major interest in this case.

The paper is organised as follow: in Section 2, we present a review of the relevant literature on the argument; in Section 3, we introduce the dataset and the methodology; Section 4 shows the results and in Section 5, we formulate some conclusive remarks.

## 2. Literature review

In order to obtain an overview of the most important variables associated with student achievements, we have summarised, in Fig. 1, the variables that are identified as influential in the literature, indicating the relationships between them. Student attainment is influenced by three main aspects: (i) the students' features, such as gender, nationality, socio-economic status, attitude towards study, etc.; (ii) the context in which students live, such as the features of their city, district, friends, etc.; (iii) school level characteristics. Regarding the latter point, based upon the literature, there are four main "groups" of variables at school level likely to affect educational performance:

- *School body composition and size*, such as the percentage of disadvantaged students, average socio-economic status of students, number of students/classes.
- *Soft aspects concerning the school*, such as school atmosphere and the relationships between teachers, students and parents.
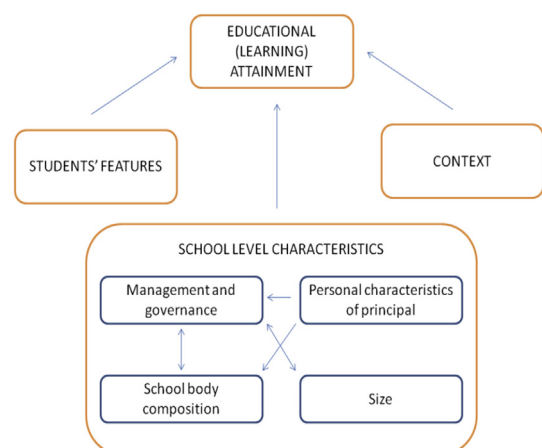


**Fig. 1.** Aspects that influence learning attainments: (i) students' features, such as gender, nationality, socio-economical status, attitude to study, etc.; (ii) the context in which students live, such as the characteristics of the city, the district, friends, etc.; (iii) school level characteristics, that are management and governance, personal characteristics of principal, size and school body composition (percentages of disadvantaged students, average socio-economical status,etc.).