

PAPER SUBMISSION

Title of Paper Student Performance in Mathematics in Portugal using PISA-2009 data

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THE ABSTRACT

Introduction, Background, and Objectives

The Programme for International Student Assessment (PISA) is an international study launched by the Organisation for Economic Co-operation and Development (OECD) in 1997. It aims at evaluating education systems worldwide by assessing 15-year-olds' competencies in three key subjects (reading, mathematics and science) every three years.

Studies based on PISA data to explain student performance are very common in literature.

This paper is based on Portuguese data from PISA 2009, and it focus on the measurement of student achievement in mathematics and on the determinants of this achievement both at the student and at the school levels.

Research Methods, Samples or Data Sources

Data on about 6298 Portuguese students and 212 Portuguese schools who participated in PISA-2009 were used to accomplish our objectives. Given the hierarchical structure of data, the models adopted for statistical analysis were multilevel models, which can take into account data variability within and among the hierarchical levels [2,3,4]. The dependent variable chosen was the student test scores in mathematics. The independent variables included student and school level variables. At the student level we distinguished between three types of variables: demographic characteristics of students (such as age, gender, or immigrant status); family characteristics of students (such as the index of socio-economic-cultural characteristics, homework help, and out of school lessons in mathematics); and cognitive/learning characteristics of students (such as their use of control and/or elaboration strategies and grade repetition). At the school level, variables were distinguished those relating to the context of the school (such as school size, type of school, location, school socioeconomic composition, and proportion of girls), to the resources the school has at its disposal (such as student-teacher ratio, computer-student ratio, and proportion of computers connected to the internet), and to the policies/strategies followed by the school (such as shortage in mathematics' teachers, ability grouping, student behavior and extra-curricular activities).

Method of Analysis

A two level multilevel linear model was used to examine the factors that most influence students' achievement in mathematics. Firstly, we fit a null model exploring differences in mathematics test scores between schools, and without controlling for any of the possible independent variables. Secondly, a student level model was developed, without variables at the school level, to examine the effects of student characteristics on their mathematics test scores. Finally, school variables were added to the student model to examine which school characteristics influence the relationship between mathematics' achievement and student level variables.

Findings

Our study provides evidence that males significantly outperformed females in mathematics, foreign-born students performed significantly lower than Portuguese-born students, and students who did not repeat grades performed significantly better than others [1].

Students' family related variables prove to be very important in explaining students' performance in mathematics. There is evidence of a negative relationship between homework help, out of school lessons in mathematics [5] and mathematics test scores.

School level variables proved less important than student level variables in explaining results, being the only significant school variables the socio-economic characteristics of the school, school size, and student behavior.

Conclusions, Scholarly or Scientific Significance, and Implications

Nearly 83% of the variance in scores can be attributed to differences in student characteristics within schools (i.e. intra-class correlation is 17%). In comparison with the null model, the final model explained about 30% of the variance at student level and about 82% of the variance at the school level.

There was a relatively large gap found between male and female scores in the present study, which is consistent with previous studies. The negative sign on the effect of the grade repetition variable suggests that students with a background of repetition tend to perform worst (repetition policies seem to be ineffective).

References

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