A Multilevel Structural Equation Model Testing the Influences of Socio-Economic Status and Pre-Primary Education on Reading Literacy in Italy

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Abstract

The aim of the present study is to examine the effect of Socio-Economic Status (SES), individual and compositional effects, and of pre-primary education on reading literacy in Italy. A multilevel structural equation model was used to examine data from 4189 fourth grade Italian students who took part in the Progress in International Reading Literacy Study (PIRLS). SES showed a significant positive direct impact on reading literacy at both student level and school level, while pre-primary education did not have a significant impact on reading literacy. The multi-group analysis showed that there were no significant differences between Italian geographical areas.

1. Introduction

Several studies detected a large gap in the reading performance of the students in the most socio-economically disadvantaged Italian regions (INVALSI, 2012; INVALSI, 2013). According to the PIRLS 2011 theoretical framework (Mullis, Martin, Kennedy, Trong, & Sainsbury, 2009) socio-economic status and pre-primary education can positively affect reading performance. Many PIRLS countries have a specific program for early childhood education (Mullis, Martin, Minnich, Drucker, & Ragan, 2012) and in Italy non-compulsory pre-primary education is provided for children before 6 years of age. Various studies showed a strong positive relationship between socio-

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economic background at the student level (Mullis et al., 2012) as well as at the school level (Alivernini, 2013) and reading achievement. Additionally, there is some evidence that fourth grade students with at least three years of pre-primary education had higher reading performances than their counterparts (e.g., Mullis, Martin, Foy, & Drucker, 2012). Although there is some evidence (e.g., Berlinski, Galiani, & Gertler) for the benefits of pre-primary education, there is a lack of studies evaluating the effect of pre-primary education on students’ achievement while taking into account the role of SES at both student level and school level.

1.1. Purpose of the study

The aim of the present study was to examine the effects of Socio-Economic Status (SES), individual and compositional effects, and pre-primary education on reading literacy in Italy. A focus of the study was on comparing Italian PON regions† (the lowest performing Italian Southern regions according to preceding information from various studies, e.g. INVALSI, 2012; INVALSI, 2013) with data from other geographical areas, in order to better understand the performance gap between different geographical areas in Italy. In order to achieve these goals a multilevel multi-group structural equation model, based on PIRLS 2011 Italian data, was developed and tested.

2. Method

2.1. Participants and procedure

The data analyzed in the present study came from the nationally representative sample of 4189 fourth grade Italian students (49.6% boys) and their parents who took part in the PIRLS 2011 study. Participating students attended 202 primary schools randomly selected from the population of Italian primary schools. In each sampled school, one or two whole classrooms were selected, and all the students in each class were assessed for the survey. Students completed the PIRLS reading literacy test and the Student Questionnaire in the classes during an ordinary school day. Parents completed the Learning to Read Questionnaire at home.

2.2. Measures

The PIRLS reading literacy test was used to assess students’ achievement in reading, the Student Questionnaire and the Learning to Read Questionnaire were used to assess SES and pre-primary education.

Students’ achievement in reading was measured using a test consisting of 135 constructed-response and multiple-choice items. The test items were distributed across 13 booklets and each student completed one booklet (Martin & Mullis, 2012). Item Response Theory models were employed to derive the reading proficiency scale from the 135 items and the plausible value methodology was used to generate five estimates of reading literacy scores for each student (Martin & Mullis, 2012). The first of the five estimates was used in the present study. The analyses were replicated using the second and the third plausible value and the results proved to be stable.

Pre-primary education was measured using 1 item in which parents indicated how long their child attended pre-primary school (ranging from: 0=no pre-primary; 1=1 year or less; 2=between 1 and 2 years; 3=2 years; 4=between 2 and 3 years; 5=3 years or more). The following indices (Van Damme, Liu, Vanhee, & Pustjens, 2010) were used as indicators of SES:

- Number of books at home: 1 item from the Student Questionnaire, ranging from 1 (0-10 books) to 5 (more than 200 books).

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†Italian PON (Programma Operativo Nazionale – National Operational Programme Education) regions are: Sicily, Apulia, Calabria and Campania. The PON is the program document for the period 2007-2013, upon which the support for the development of human resources with the use of the European Social Fund and national resources is provided.
- Educational aids at home: 3 items from the Student Questionnaire. The variable was constructed by taking the sum of three variables: PC at home, own study desk, own books.

- Parents' highest occupational level: 2 items from the Learning to Read Questionnaire. The variable was constructed by collapsing the response options in the following categories (Foy & Kennedy, 2008): 1 = never worked outside home for pay; 2 = general worker; 3 = skilled worker; 4 = clerical; 5 = small business owner; 6 = professional.

- Parents' highest educational level: 2 items from the Learning to Read Questionnaire. The variable was constructed by collapsing the response options in the following categories: 1 = some primary, lower-secondary or no schooling; 2 = finished lower-secondary education; 3 = finished upper-secondary education; 4 = finished post-secondary, but not university; 5 = finished university or higher.

2.3. Data Analysis

The process of analysis was carried out in three stages using the MPlus 6.0 software with the Robust Maximum Likelihood (MLR) estimator.

Firstly, a multilevel confirmatory factor analysis (CFA) was performed to examine a measurement model in which the four indices described previously were used as indicators of the latent constructs of SES.

Secondly, a multilevel structural model (Heck & Thomas, 2009) was specified considering pre-primary education as a predictor of reading literacy at the student level and SES as a predictor of reading literacy both at the student and at the school level. In addition, since in Italy pre-primary schooling is not compulsory, it was assumed that SES might have an effect on attendance of pre-primary school.

Thirdly, a multi-group analysis was conducted in order to verify the invariance of the model across two Italian geographical areas (PON regions vs. other regions). In this analysis, we compared the model in which cross-group equality constraints were imposed on the estimates of structural and measurement parameters with a baseline model in which only the parameters of the measurement part were held equal but all the structural parameters were estimated freely within the two groups (Byrne & van de Vijver, 2010).

In order to evaluate the extent to which the hypothesized models were supported by the observed data, we relied on MLR chi-square test statistic and on multiple indices of fit (CFI, TLI, RMSEA, and SRMR; Hu & Bentler, 1999; Schreiber, Nora, Stage, Barlow, & King, 2006).

3. Results

The results of the multilevel CFA showed a good fit the measurement model of SES: \( \chi^2 (8) = 42.027, p < .001; \) CFI = .984; TLI = .976; RMSEA = .032; SRMR within = .019; SRMR between = .098.

The results of the analysis on the multilevel structural model regarding the impact of SES and pre-primary education on reading literacy are shown in Figure 1. The model had a good fit and explained 16% of the variance of reading literacy at the student level and 31% of the variance of the reading literacy at the school level (see Fig. 1). SES showed a significant positive direct impact on reading literacy at student level (\( \beta=34.97; p<.001 \)) and at the school level as a compositional effect (\( \beta=38.87; p<.001 \)). At the student level, SES showed also a significant positive impact (\( \beta=.22; p<.001 \)) on pre-primary education. Pre-primary education did not have a significant impact on reading literacy (\( p=.21 \)).

The multi-group analysis proved the full structural invariance of the model across different Italian geographical regions (\( \Delta \text{CFI} <.01 \)). This result indicates that there are no significant differences between PON regions and other regions in the effect of SES (both at student and at school level) and of pre-primary education on reading literacy.
4. Discussion

The model tested in this paper provides new information about the role of SES in terms of compositional effects and about the long-term influence of pre-primary education. In fact, this is the first study in the Italian context to provide estimates of the individual and compositional effects of SES on reading literacy on the basis of PIRLS data. The results show that the influence of SES was significant, as expected, at the student and at the school level and that these effects were constant for very different Italian geographical areas. As regards the role of pre-primary education, this study shows that when the influence of SES are taken into account the long-term effect of pre-primary education on reading literacy is not evident in the Italian context.

Of course this study does not exclude some shorter-term effects of pre-primary education. For example Berlinski and colleagues (2006) found that third grade students’ achievement was significantly increased by the former attendance of pre-primary school. While the results of the present study suggest that there is no general effect of pre-primary education, they leave open the possibility that students’ achievement can be influenced by some specific pre-primary school programs. Significant benefits have been found, for example, with programs for disadvantaged children (e.g. Garces, Thomas, & Currie, 2002).

Preprimary education has an important role in preparing children for school and for life, which goes far beyond improving reading skills. Pupils’ attitudes towards studying, perceptions of competence and social skills are just some examples of other possible relevant consequences of pre-primary education. Future studies could therefore focus on examining the long-term effects of pre-primary education on multiple outcomes.

References


