




## The principal's effectiveness in student achievement in Peruvian schools

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### ORIGINAL ARTICLE

#### KEYWORDS

headteachers, effective schools, Peru, Young Lives.

**Summary:** The current investigation analyzes the effect that the school principal has had on the performance of students. It begins with a review of the literature on the effectiveness of the principal, its characteristics and its particularities in Peru. Then, it develops the empirical section by using longitudinal data from the Young Lives program and its School Survey; and by using educational production functions, implementing instrumental variables, it estimates the effect of the principal on students' performance on standardized tests of mathematics and language. The principal outcome of the study is linked to a positive effect of the principal on student performance, with an important magnitude, associated with the characteristics of a developing country.

### PALABRAS CLAVE

director; efectividad escolar; Perú, Young Lives.

**Resumen:** La presente investigación analiza el efecto que ha tenido el director de la escuela sobre el rendimiento de los estudiantes. Inicia con una revisión de la literatura sobre la efectividad del director, sus características y sus particularidades dentro de Perú. Luego desarrolla la sección empírica usando los datos longitudinales del Programa Young Lives y su Encuesta Escolar; y, mediante el uso de funciones de producción educativas, empleando variables instrumentales, se estima el efecto del director sobre el rendimiento de los estudiantes en pruebas estandarizadas de matemáticas y lenguaje. Los principales resultados del estudio se relacionan con un efecto positivo del director en el rendimiento estudiantil, con magnitud importante, asociado a las características de un país en vías de desarrollo.

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## 1. INTRODUCTION

Education is a means and end in the development of an individual's capacities (Sen, 2012), which makes it an instrument of social mobility that contributes to the improvement and wellbeing of a person and population as a whole (Romer, 1990). There are several levels of education; the most important are the ones which affect the child's development since childhood, for this reinforces the formation of cognitive and non-cognitive abilities. (Cunha y Heckman, 2007).

Academic coverage has increased all over the world, due to the fact that more and more people are being able to access school, which has made the education debate focus on its quality. The principal facts that are being analyzed in literature in relation to educational quality are: teachers, classmates, educational competence and characteristics of students. (Hanushek 1986, Hoxby 2000, Gallego, 2002, Rockoff 2004). Currently the role of the director has been associated to the quality of education (Grissom *et al.* 2011; Loeb *et al.* 2012; Grissom *et al.* 2015).

In Latin American and the Caribbean region, due to the several roles that the principal undertakes, the study of the effectiveness of the principal and its relation to student's performance has become particularly relevant (Oplatka, 2016). According to research performed in a qualitative form, it has been stated that the role of the principal is essential, and has even greater importance in situations of vulnerability (Weinstein y Muñoz, 2012; Bellei *et al.*, 2014).

This study focuses on Peru and uses a quantitative methodology, where there are important academic challenges, placing it under the South American standard (OCDE, 2018). Research on education in this country has found out that academic performance is related to external factors, such as economic status. There are also internal factors such as the educational process, management, and teachers (Cueto *et al.*, 2013; Freire y Miranda, 2014). Currently there have been two quantitative investigations on the importance of the principal in student achievement (Miranda, 2015; Rivera, 2018).

In this context, the purpose of this investigation is to analyze the effectiveness of the principal in the performance of students of Peruvian schools, implementing a methodology with instrumental variables, which can be an input for people in charge of educational policies. This study uses longitudinal data, which has been produced by the Young Lives program, recollected by household surveys in 2002, 2006 y 2009, and the School Survey carried out in 2011. In the estimation some educational production function models are implemented, using ordinary least squares and instrumental variables, correcting endogeneity bias.



## 2. METHOD AND MATERIALS

The main source of information of this research comes from the program Young Lives through three household surveys in 2002, 2006, and 2009 and the School Survey of 2011<sup>3</sup>. This program refers to a investigation program which took place in four countries: Ethiopia, India, Peru and Vietnam; for which a follow up is undertaken to a total of 12,000 children in fifteen years, and 572 Peruvian students are included from the School Survey which are distributed among 132 primary school institutions in 10 regions. The representativeness of the program has been analyzed by Escobal y Flores (2008), finding out that the socioeconomic estimates are similar to the Peruvian national survey ENAHO.

Within household surveys, there is information related to the father's education, mother's education, mother tongue, gender, wealth, and standardized tests of mathematics and language. In addition, there is also information about the kind of school, course size, experience and teacher's education, experience and principal's education, parent education of classmates, type of school, and information on the director, with whom the research variable is constructed, which is the effectiveness of the director<sup>4</sup>.

Taking into account the kind of school, it has been found out that private schools have particular characteristics which are related to obtaining better result in mathematics and language tests. These characteristics are: parents' higher education, less indigenous mother tongue, higher access to internet, teachers with less experience, education and principal's effectiveness. At the same time, urban public schools present intermediate characteristics in the mentioned elements, and rural schools are the ones with lower scores. Table 1 shows descriptive statistics:

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<sup>3</sup> “The data used in this publication come from Young Lives, a 15-year study of the changing nature of childhood poverty in Ethiopia, India (Andhra Pradesh and Telangana), Peru and Vietnam ([www.younglives.org.uk](http://www.younglives.org.uk)). Young Lives has been core-funded by UK aid from the Department for International Development (DFID)”.

<sup>4</sup> The principal's effectiveness is built taking into account the articles of Scheerens (2004), Grissom *et al.* (2012) and Rivera (2018). This information is obtained from the teachers' perception of the director and his type of administration. With this, a binary variable is generated: 1 (effective director) and 0 (non-effective director).

Table 1

*Descriptive statistics of children in Peru and their context (2011)*

Variables	Urban Private	Urban Public	Rural Public
Math test	0.68 (0.18)	0.54 (0.19)	0.33 (0.18)
Previous math test	0.57 (0.16)	0.51 (0.14)	0.39 (0.14)
Language test	0.82 (0.13)	0.73 (0.15)	0.57 (0.18)
Previous language test	0.70 (0.17)	0.63 (0.20)	0.40 (0.22)
Mother education	12.26 (3.28)	8.56 (3.57)	4.78 (3.09)
Father education	11.53 (4.46)	9.58 (3.45)	7.10 (3.88)
Indigenous mother tongue	0.16 (0.37)	0.19 (0.40)	0.77 (0.43)
Male gender	0.68 (0.48)	0.46 (0.50)	0.56 (0.50)
Wealth index	0.77 (0.13)	0.62 (0.16)	0.36 (0.14)
Peer education	12.55 (2.01)	10.33 (2.63)	4.78 (2.62)
Internet access	0.95 (0.23)	0.72 (0.45)	0.11 (0.31)
Course size	19.68 (8.03)	27.71 (6.86)	13.86 (5.75)
School type	0.05 (0.23)	0.29 (0.45)	0.77 (0.43)
Services	1.00 (0.00)	0.58 (0.49)	1.00 (0.00)
Teacher experience	12.05 (8.09)	20.88 (5.88)	15.93 (6.83)

Teacher education	0.00 (0.00)	0.36 (0.48)	0.15 (0.36)
Director's Experience	9.47 (6.61)	9.46 (5.43)	4.79 (4.24)
Director's education	0.68 (0.48)	0.50 (0.50)	0.11 (0.31)
Director effectiveness	1.00 (0.00)	0.77 (0.42)	0.55 (0.50)
N	300	300	300

Note: The data source is *Young Lives*.

For the estimation, educational production functions based on the contributions of Todd and Wolpin (2003) are used, both for mathematics and language. These functions have been adjusted according to contributions of Andrabi (2011) *et al.* (2011) and Todd y Wolpin (2007) where the previous tests scores are incorporated, which allows to have better estimations (Chetty *et al.*, 2014). Within the estimation, as it is shown in the descriptive statistic, the principal's effectiveness is likely related to the type of schools, the private ones, for which the results can be inclined to areas where the designation of principals is not random (Loeb *et al.*, 2012; Díaz y Saavedra, 2000).

Because of this, the proposed model is initially created with Ordinary Least Squares, and it is compared to an estimated model through Instrumental Variables. The advantage of the use of Instrumental Variable is that it can transform the variable of interest into exogenous, and its incorporation to the model is done through estimation in two stages. For which, the canonical work of Card (1993) has been taken into account, in which a geographical variable related to distance is used, which meets the conditions of relevance and exogeneity.

In this process the household data and the school survey were combined, and with this, the model is estimated:

$$Y_{it} = \alpha + \rho X_{it} + \beta ED_{it} + \beta Z_{it} + \beta Y_{it-1} + \varepsilon_i$$

where Y is the math / language score within the standardized test, X is a vector of variables associated with the characteristics of the household, teachers, classmates and school, ED is the principal's Effectiveness variable, and Z is the instrumental variable of principals distance to their school.



### 3. RESULTS

Principal's effectiveness is one of the important inputs, which is related to the school success. Around the world, many qualitative studies have been carried out, making emphasis in the potential of principals in the performance of educators and students. What is new, it is the measurable approximations of principal efficiency across educational production means (Grissom *et al.*, 2015). In the region, principal's using educational production functions are limited (Oplatka, 2016). Among the conducted research, it has been found that the role of the principal is essential in the success of the school, which is even more significant in contexts of vulnerability (Weinstein y Muñoz, 2012; Bellei *et. al.*, 2014).

In Peru, few investigations has been done on this subject, therefore, this investigation seeks to be a contribution to this area. The Peruvian academic setting is categorized by the provision of the service from a type of public, private and mixed administration. The registration of students at the primary and secondary levels resembles to around 80% in the public sector (Guerrero *et al.*, 2012). Over time, coverage has increased and now the debate turns on quality (Sánchez, 2008). From the studies that analyze the educational system it has been found that there are breaches in educational performance between public and private institutions, the latter being higher (Miranda, 2015; Guadalupe *et al.* 2013; Guerrero *et al.* 2012). Among the most important factors related to achievement gaps, the socioeconomic level of students is greatly linked to their academic performance (Cueto, 2007). At the same time, Cueto *et al.* (2013) finds out that learning in schools is related to curriculum coverage, correctly solved exercises, teacher feedback and cognitive demand. Among the investigation related to the role of the principal, it is determined that it has a positive effect that is between 0.2 and 0.3 standard deviations in the performance of students in mathematics and language (Rivera 2018, Freire y Miranda, 2014).

In this document, an innovation is made to these quantitative investigations in Peru, taking advantage of the possibility of correcting the selection bias of the directors by using Instrumental Variables related to distance, built on the idea of Card (1993). With this, higher estimates of the director effect are obtained with IV in comparison to those of the OLS.

With this reference and context, table 2 presents the estimation of the model through the OLS and Instrumental Variables for mathematics and language. Among the principal results, it is evident the inequality of the education system in Peru, where internal and external factors matter. On one side, among the external factors, it has been found out that the mother education and the family wealth have a positive effect in the performance of students, which has been found by Cueto (2011) y Guadalupe (2013). Also, among the internal factors, school management, teachers and



principals' education have positive effects on the student performance. There is also a relation between the scores of the previous test and the current one. This helps to perceive the importance of an effective early intervention and support (Heckman, 2011).

Being the main result of this investigation, it is found that the director effectiveness is vital in the student performance, for both estimations of OLS and IV, being the second superior. On one hand, in mathematics, a school with an effective principal allows its students to increase their results in a 0.55 standard deviation. Likewise, an effective principal makes its student, in language, increase their results in a 0.87 standard deviation.

This result is related to the previous documents like Cueto (2007) where it was found that the school principal has an important role in the institution, the work conducted by Rivera (2018), in which the principal is essential for educational performance, and with Freire and Miranda (2014) where it was stated that the school director had a higher influence in language since there is a greater preparation and knowledge in this subject. However, the results of this research are highly different to the previous ones, because the principal effect is superior, once it is estimated with Instrumental Variables. With this, it is evident the role of the director in an education system that has many inequalities, having the potential to reduce the gap in student's performance and improve well-being.

Table 2

*Educational function's model of children in Peru and its context (2011)*

Variables	Math	Math	Language	Language
	(OLS)	(IV)	(OLS)	(IV)
Mother education	0.04*** (0.02)	0.04*** (0.01)	0.04*** (0.02)	0.04*** (0.02)
Father education	-0.01 (0.01)	-0.02 (0.01)	0.01 (0.02)	0.00 (0.02)
Indigenous mother tongue	-0.01 (0.12)	0.02 (0.11)	0.08 (0.13)	0.15 (0.13)
Male gender	0.08 (0.09)	0.08 (0.08)	0.05 (0.09)	0.04 (0.09)
Wealth index	0.72** (0.30)	0.78*** (0.30)	0.10 (0.35)	0.25 (0.37)

Peer education	-0.02 (0.02)	-0.03 (0.02)	-0.00 (0.02)	-0.03 (0.03)
Rural sector	-0.11 (0.17)	-0.10 (0.16)	-0.19 (0.17)	-0.17 (0.17)
Internet access	-0.07 (0.14)	-0.01 (0.15)	0.00 (0.15)	0.14 (0.17)
Course size	0.00 (0.01)	0.00 (0.01)	0.01 (0.01)	0.00 (0.01)
School type	-0.05 (0.11)	-0.10 (0.12)	0.05 (0.11)	-0.08 (0.13)
Services	-0.00 (0.10)	-0.02 (0.10)	0.13 (0.11)	0.08 (0.12)
Teacher experience	0.02** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.04*** (0.01)
Teacher education	0.37*** (0.13)	0.41*** (0.13)	0.28** (0.12)	0.39*** (0.13)
Private management	0.43* (0.24)	0.41* (0.24)	0.45** (0.22)	0.40* (0.21)
Director's Experience	0.00 (0.01)	0.00 (0.01)	-0.01*** (0.01)	-0.01 (0.01)
Director's education	0.30*** (0.11)	0.27** (0.11)	0.16 (0.11)	0.10 (0.12)
Director effectiveness	0.31*** (0.12)	0.55*** (0.06)	0.21* (0.11)	0.87** (0.42)
Previous test	0.56*** (0.07)	0.57*** (0.20)	0.34*** (0.05)	0.33*** (0.06)
Constant	-1.14*** (0.32)	-1.19*** (0.31)	-0.97*** (0.30)	-1.14*** (0.32)
N	300	300	300	300

Note: The data source is Young Lives. The dependent variable is the math / language score. The numbers within the parentheses correspond to the standard errors of the delta method. Level of significance: \* 0.10, \*\* 0.05, and \*\*\* 0.01.

#### 4. DISCUSSIONS



In developing countries, there are other variables that can be included in the model with the intention of adjusting the context characteristic. In this sense, it has been included to the previous model some variables related to the absence of teachers to schools, which has impact on performance (Chaudhury *et al.*, 2006; Alcázar *et al.*, 2006; Cueto, 2008). In addition, the fixed effects by department are included, the proportion of public schools by department, and the characteristic of separate grades in schools.

Table 3 presents the estimation of the extended model through OLS and Instrumental Variables for mathematics and language. From both estimations, the one performed by VI found a higher effect, correcting a possible bias estimation. Among the results, the principal's effectiveness is the main variable that has positive effects in the student performance in both tests: in mathematics the effect is a 0.75 standard deviation, and in language is a 0.80 in standard deviation. This result can be placed within a Peruvian context taking into consideration the work by Guerrero (2013), so the principal's effectiveness can increase the student's probabilities of access to college in a 0.8 standard deviation.

This result corresponds to what has been found in the region. School principals develop a multiple functions related to resources administration, school performance, interlocution with stakeholders, among other tasks, which makes them fundamental in the education process (Oplatka, 2016). In this line, the result by Instrumental Variables explains in an effective form the director's role in relation to the school performance. In Peru, with a high diverse context, it is highlighted the principal's effect and its influence on students results, with it, school leadership is fundamental to improve the school quality, increasing the student's impact.

Among other results, what was obtained in previous model is maintained, in which mother education and teacher education are important for academic performance. This finding corresponds with Hanushek (1995) where it is manifested that the role of the educator is crucial in school and it is essential in developing nations.

Table 3

*Extended Educational function's model of children in Peru and its context (2011)*

Variables	Math	Math	Language	Language
	(OLS)	(IV)	(OLS)	(IV)
Mother education	0.03** (0.01)	0.04** (0.01)	0.04** (0.02)	0.04*** (0.01)

Father education	-0.00 (0.01)	-0.01 (0.01)	0.00 (0.02)	0.00 (0.02)
Indigenous mother tongue	0.03 (0.13)	0.04 (0.13)	-0.03 (0.15)	-0.02 (0.15)
Male gender	0.07 (0.09)	0.06 (0.09)	-0.01 (0.10)	-0.03 (0.09)
Wealth index	0.41 (0.33)	0.61* (0.33)	-0.07 (0.36)	0.15 (0.36)
Peer education	-0.01 (0.03)	-0.03 (0.03)	-0.02 (0.02)	-0.04* (0.02)
Rural sector	-0.17 (0.18)	-0.18 (0.18)	-0.13 (0.20)	-0.14 (0.19)
Internet access	-0.16 (0.15)	-0.02 (0.16)	-0.00 (0.16)	0.15 (0.16)
Course size	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
School type	-0.03 (0.21)	-0.19 (0.20)	0.08 (0.17)	-0.10 (0.17)
Services	0.02 (0.12)	-0.04 (0.12)	0.07 (0.12)	0.00 (0.12)
Teacher experience	0.02* (0.01)	0.03*** (0.01)	0.03*** (0.01)	0.05*** (0.01)
Teacher education	0.47*** (0.13)	0.50*** (0.13)	0.29** (0.13)	0.33*** (0.12)
Private management	0.31 (0.25)	0.30 (0.24)	0.43** (0.22)	0.43** (0.20)
Director's Experience	0.00 (0.01)	0.00 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Director's education	0.23 (0.12)	0.18 (0.12)	0.16 (0.12)	0.12 (0.12)
Director effectiveness	0.23* (0.12)	0.75*** (0.21)	0.22* (0.12)	0.80*** (0.24)
% public schools	0.30 (0.93)	0.43 (0.93)	-1.04 (0.94)	-0.93 (0.92)



Grades	-0.45 (0.17)	-0.51*** (0.17)	-0.23 (0.21)	-0.31 (0.21)
Fixed effects	Sí	Sí	Sí	Sí
Previous test	0.59*** (0.07)	0.59*** (0.06)	0.33*** (0.06)	0.32*** (0.05)
Constant	-1.10*** (0.96)	-1.23 (0.95)	-0.04*** (1.00)	-0.18 (0.97)
N	300	300	300	300

Note: The data source is Young Lives. The dependent variable is the math / language score. The numbers within the parentheses correspond to the standard errors of the delta method. Level of significance: \* 0.10, \*\* 0.05, and \*\*\* 0.01.

## 5. CONCLUSIONS

Education allows development in societies. Equal opportunities of access and the foster of capacities from early age, makes possible the reduction of inequality gaps in society. In this sense, education is a collective good that becomes a social compromise.

Literature has found out that there are essential elements in the education process, where the role of the school principal is important. The effects found in the context of developed nations such as the United States is between a 0.1 and 0.2 standard deviation. In Latin America, where there is less institutionalized school system, the role of the Director is crucial, since it assumes various responsibilities associated to school management and performance.

In Peru, estimations related to the principal's effect have found effects between a 0.2 and 0.3 standard deviation. In this research, an innovation takes place, taking into consideration the possibility of correcting a bias of principal's school, with the help of instrumental variables related to distance; with it, the impact of the principal is between a 0.5 and 0.8 in standard deviation. This result is interesting for the people in charge of public policies, because the role of the school director is essential for management and effectiveness, having the potential to reduce inequality.

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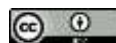
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Los autores declaran que no incurre en conflictos de intereses.

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#### **Aspectos éticos / legales; Ethics / legals:**

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