

The Effect of Educational Efficiency on Regional Development in Mexico

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Abstract

The Mexican education system faces challenges due to social and regional gaps, including a lack of teaching staff, pedagogical materials, updated study programs, insufficient infrastructure, and services, lower government expenditure on education, and academic staff with poor training programs. Furthermore, access to education is low for vulnerable groups, especially in rural areas. Therefore, the evaluation of this system has gained importance. Through this study, the efficiency evaluation of Mexican education and its relationship with regional, economic, and social development is analyzed through a two-stage Network Data Envelopment Analysis (NDEA) model. Stage 1 calculates the efficiency of the educational process at three academic levels: Primary school, Junior high school, and High school, while Stage 2 evaluates the relationship between education and regional, economic, and social development. As the analysis includes information from all 32 Mexican states over five academic years from 2000 to 2020, the Malmquist productivity index was used to examine productivity changes at both stages. The results revealed that better educational quality is associated with higher regional, economic, and social development, but this development is not reflected in higher efficiency in the development stage.

Introduction

Despite advances, the average expenditure per student in Mexico decreased between 0.3% and 0.5% annually, because enrollment grew faster than educational expenditure (OECD, 2022). As a consequence, primary school teachers received around 40% less salary than the OECD average during their first ten years of experience, and 26% less in junior high school (OECD, 2022). Furthermore, 40% of the teaching staff did not complete the required training programs and three out of ten primary school teachers did not have a higher education degree (García, 2018).

Low educational quality, limited social development, and a scarcity of economic opportunities have driven migration to more prosperous regions (Eggert et al., 2010). Educational access is especially limited in rural areas, where long distances represent a significant barrier (Ama et al., 2020) and low population density increases investment costs (Cattaneo et al., 2022). In these communities, six out of ten youths aged 15 to 17 lived isolated and without nearby schools; 13.2% of those in extreme poverty did not attend compulsory education, and three out of ten students dropped out of school due to a lack of resources (García, 2018).

Educational continuity also faces challenges. The net enrollment rate in primary school decreased from 94.8% in 2014 to 89.8% in 2022 (SEP, 2022). The completion rate was 96.7% in primary school, 91.0% in junior high school, and 64.9% in high school. A greater allocation of resources could reduce interregional migration and improve economic performance (Eggert et al., 2010).

The Mexican education system has had difficulties responding to demographic changes and social, economic, and cultural inequalities, which has limited its contribution to development (Roldán Vera & Robles Valle, 2021; Puryear et al., 2012). In this context, the present study evaluates educational efficiency in Mexico and its relationship with regional, economic, and social development through a two-stage Network Data Envelopment Analysis (NDEA) model. The analysis uses official data from the National Educational System and the Human Development Index of the 32 federal entities.

The study is guided by the following research questions:

- **RQ1:** What is the efficiency level of the educational process at the analyzed levels?

- **RQ2:** Are there significant differences in educational efficiency according to academic level?
- **RQ3:** What factors explain higher educational efficiency?
- **RQ4:** Does higher educational efficiency translate into better regional, economic, and social development?

The article is organized as follows: the next section presents a literature review on DEA applications in education and development; the Materials and Methods section describes the NDEA methodology and the database; the Results section presents the efficiency scores and the relationship between education and development; finally, the Discussion section analyzes the implications, limitations, and future research lines.

Conclusions

This article analyzed the Mexican education system and its relationship with regional, economic, and social development using a two-stage network DEA model, with data from five academic cycles between 2000 and 2020, and was structured around four research questions.

In response to RQ1, the average efficiency of the educational process was relatively high but heterogeneous (0.777 in primary, 0.697 in junior high, and 0.805 in high school), with a decreasing trend throughout the analyzed period. Regarding RQ2, significant differences were identified by academic level: junior high differs from primary and high school, while the latter two do not differ significantly from each other, a pattern consistent with DEA studies in other developing countries. Regarding RQ3, contrary to the conventional assumption that a greater number of teachers and schools improves efficiency, the analysis showed that the most efficient states operate with lower teacher-student and school-student ratios, suggesting that teacher and infrastructure quality weighs more than the quantity of resources. Finally, in response to RQ4, greater educational efficiency did not translate into greater efficiency in regional, economic, and social development; in fact, an inverse relationship was observed, consistent with regional convergence theory: states with higher educational efficiency (Mexico City, Puebla, Querétaro, Tabasco, Tlaxcala) showed lower efficiency in the development stage, despite exhibiting slightly better absolute values in life expectancy and GDP, while states

with lower educational efficiency (Colima, Durango, Michoacán, Oaxaca, Veracruz) achieved the highest efficiencies in that stage despite slightly lower absolute indicators.

These results suggest that educational policies aimed solely at increasing resources have a limited scope if they are not accompanied by strategies to improve teacher quality and infrastructure, and that the link between education and regional development in Mexico is neither automatic nor linear.