Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

https://doi.org/10.23913/ride.v15i29.2214

Scientific articles

Gasto público en educación para la formación de capital humano: la experiencia de México

Public spending on education for the formation of human capital: The experience of Mexico

Gastos públicos em educação para a formação de capital humano: a experiência do México

Oshiel Martínez Chapa
Universidad Autónoma de Tamaulipas, México
omartinez@uat.edu.mx
http://orcid.org/0000-0001-9675-5472

Jaime Gerardo Malacara Navejar
Universidad Autónoma de Tamaulipas, México
jmalacara@docentes.uat.edu.mx
http://orcid.org/0000-0002-1914-2792

Resumen

Es preciso que los gobiernos realicen inversiones significativas para desarrollar el capital humano en la perspectiva de alcanzar un mayor crecimiento económico. En este trabajo se analizó el gasto público en el capital humano, en específico en el relativo a la educación, tema importante entre aquellos países que conforman la Organización para la Cooperación y el Desarrollo Económicos (OCDE), entre los cuales se halla México. La hipótesis planteada es que los gobiernos que destinan un gasto público significativo y acorde a las necesidades para la formación de capital humano mejoran el bienestar de sus ciudadanos. La presente es una investigación teórica y documental con enfoque explicativo y recurre a datos procedentes de la Secretaría de Educación Pública (SEP), la OCDE y la Comisión Económica para América Latina (CEPAL). Los resultados demostraron que, si bien en México se han destinado más recursos a lo largo del tiempo, aún hace falta profundizar dicho gasto, en específico para ampliar la cobertura y modernizar su infraestructura. Se concluyó en la

necesidad de privilegiar un mayor presupuesto, además de mejoras significativas en la calidad de los servicios educativos.

Palabras clave: gasto público educativo, formación de capital humano, crecimiento económico.

Abstract

Governments need to make significant investments to develop human capital with a view to achieving greater economic growth. In this work, public spending on human capital was analyzed, specifically in relation to education, an important issue among those countries that form the Organization for Economic Cooperation and Development (OECD), among them is Mexico. The hypothesis proposed is that governments that allocate significant public spending in accordance with the needs for the formation of human capital improve the well-being of their citizens. This is a theoretical and documentary investigation with an explanatory approach and it uses data from the Ministry of Public Education (SEP), the OECD and the Economic Commission for Latin America (ECLAC). The results showed that although more resources have been allocated in Mexico over time, this spending still needs to be deepened, specifically to expand coverage and modernize its infrastructure. It was concluded that there was a need to prioritize a larger budget, in order to get significant improvements in the quality of educational services.

Keywords: public educational spending, human capital formation, economic growth

Resumo

Os governos precisam de fazer investimentos significativos para desenvolver o capital humano com vista a alcançar um maior crescimento económico. Neste trabalho foram analisados os gastos públicos com capital humano, especificamente em relação à educação, questão importante entre os países que compõem a Organização para a Cooperação e o Desenvolvimento Econômico (OCDE), entre os quais está o México. A hipótese proposta é que os governos que alocam gastos públicos significativos de acordo com as necessidades de formação de capital humano melhoram o bem-estar dos seus cidadãos. Trata-se de uma investigação teórica e documental com abordagem explicativa e utiliza dados do Ministério da Educação Pública (SEP), da OCDE e da Comissão Econômica para a América Latina (CEPAL). Os resultados mostraram que, embora tenham sido atribuídos mais recursos ao

México ao longo do tempo, esta despesa ainda precisa de ser aprofundada, especificamente para expandir a cobertura e modernizar a sua infraestrutura. Concluiuse que havia necessidade de priorizar um orçamento maior, além de melhorias significativas na qualidade dos serviços educacionais.

Palavras-chave: gastos públicos com educação, formação de capital humano, crescimento económico.

Reception date: July 2024 **Acceptance date:** December 2024

Introduction

According to the Organization for Economic Cooperation and Development **(**OECD **,** 2022**)**, public spending on human capital formation considers aspects related to direct spending on educational institutions, as well as public subsidies granted related to education, directed to households and administered by said institutions. It should be noted that the aforementioned indicator is shown as a percentage of the Gross Domestic Product (GDP), which is divided according to the primary, secondary and tertiary levels. Public entities include ministries or agencies in charge of this area. This indicator shows the priority given by governments to education with respect to other areas of investment, such as health, social security, defense and public safety.

Investment in education is a central element for the development of human capital and is of growing importance for governments that aim to increase the well-being of their population. Investment in education is measured in terms of expenditure on formal schooling, although it is agreed that the dimension of the educational phenomenon is broader, since it does not only consider market benefits or increased wages (Solow, 1956; Knowles and Owen, 1995; Temple, 1998; Acevedo Muriel, 2018: Lozano Rosales *et al,* 2021; Contreras López *et al*, 2021).

The theory on human capital becomes relevant with respect to the way in which individuals improve their socioeconomic condition once significant investments are made in aspects related to health, education, training, and scientific and technological development. Organizations and individuals achieve greater development potential, thereby reducing poverty in countries. Acevedo Muriel (2018) argues that the economic growth of industrialized nations is related to this type of investment, as they thus achieve higher rates of profitability.

The main objective of this paper is to analyze the impact of public spending on education on the formation of human capital. The hypothesis is that governments that allocate adequate public spending to the formation of human capital improve the well-being of their citizens. This paper is made up of the following sections: the first part reviews the literature, the second part deals with the use of materials and methods, the third part addresses the results, the fourth highlights the discussion, then the conclusions are indicated and finally the future work is indicated.

Literature review

Education should also be seen as a fundamental right with externalities expressed in terms of cultural and social benefits that go beyond the purely economic sphere. Human capital, in the words of Vecino Guerra and Záldivar Castro (2016), is that which is expressed in the form of scientific-technical, cultural and ethical knowledge, accumulated in independent people or grouped in work teams, in a company or in society, in order to value work based on the use of knowledge with the goal of achieving productive objectives with social and economic value.

Since Mexico joined the OECD in 1994, The level of spending on education has increased. However, there is a gap between the countries in question and those that have achieved higher levels of social well-being. The fact that the increase in productivity observed in developed nations is explained by the contribution of education to scientific and technological development, as well as health and other material living conditions should not be overlooked.

Among the pioneering up to recent works that have been carried out in this line of knowledge at international and national levels, those detailed below should be highlighted.

Islam (1998) studies the patterns of convergence between countries through the aggregate production function, noting the differences in economic performance. In the referred work it is observed that the differences between countries occur due to the preponderant role of conditions such as governance and the existence of an educational, scientific and technological policy. These factors turned out to be significant in the explorations of the patterns of economic growth.

Continuing this line of research, Iglesias and Neira (1996) analyse the evolution of public spending on education in terms of monetary allocations, number of students and GDP per capita in some OECD countries from 1985 to 1992. The authors use an Ordinary Least

Squares econometric model, employing these variables expressed in logarithms. The results reveal the existence of divergent impulses in growth between the countries in question.

Among the studies that show the relevance of social investment, those of Ray (2002) should be noted. He points out that with higher levels of economic growth, citizens have greater opportunities to improve nutrition, employment, health, education and, in general, the income of the population, as well as other material goods. The expansion of well-being is the result of the combination of a series of social, economic and institutional factors, which contribute to enhancing human capabilities.

In terms of economic relations between countries, there is clear evidence regarding the role played by greater investments in human and physical capital in order to achieve higher levels of productivity. Thus, education must provide the changes required for this transformation and there are various factors that contribute to forming this capital, with educational institutions and productive organizations being essential (Carnerio, Hansen and Heckman, 2003).

In his research on the effects of schooling on development and growth, Hojo (2003) proposes to relate education rates and their influence on economic growth in a sample of countries. This research highlights that education itself is not necessarily the main cause of social change, but rather the relevant role of its indirect effects on society should be ensured.

In the case of Mexico, when considering the regional part, Díaz Bautista and Díaz Domínguez (2003) report the existence of a close link between education, technological and scientific development with the purpose of improving the living standards of citizens. In the work in question, it is noted that regional disparities in terms of per capita income , conditioning the study to the variables of human capital for the period 1970-2000, increased from the liberalization of the economy undertaken since the mid-eighties of the last century.

Agasisti 's work (2014) examines public spending in 20 OECD countries in the period 2006-2009, using data from the results of the international Programme for the Study of Public Spending (PPE). For International Student Assessment (PISA), which measures students' ability to use their knowledge and skills in reading, mathematics and science; it also looks at per capita spending, unemployment rate and other variables. The results show a stable efficiency in the main areas in the countries studied.

An equally recent work on this topic is that of Dufrechou (2016), which highlights trends of convergence in public spending on education, noting in the results that the greatest benefits are obtained by high-income countries.

Regarding the importance of public spending on education, Contreras López, López Garrido and Jimenez Rico (2021) show that this expenditure shows a general growth pattern over time. However, when compared with other OECD countries, it is insufficient.

On the other hand, according to Martínez Chapa (2021), life has a dimension that transcends the eminently economic aspects. Its value cannot be calculated since it is more than a subject that produces and consumes satisfactions. Each individual has different traits in terms of aspects related to education, food, work and other activities. Since ancient times, the progress of societies based on culture, economy and resources has been noted, but also favored by the diversity of skills, abilities and experiences used to improve daily sustenance.

On the other hand, international organizations, including the OECD and the United Nations Educational, Scientific and Cultural Organization (UNESCO), highlight in their respective public policy recommendations the need for governments to invest sufficient economic resources in education, health, infrastructure, as well as science and technology.

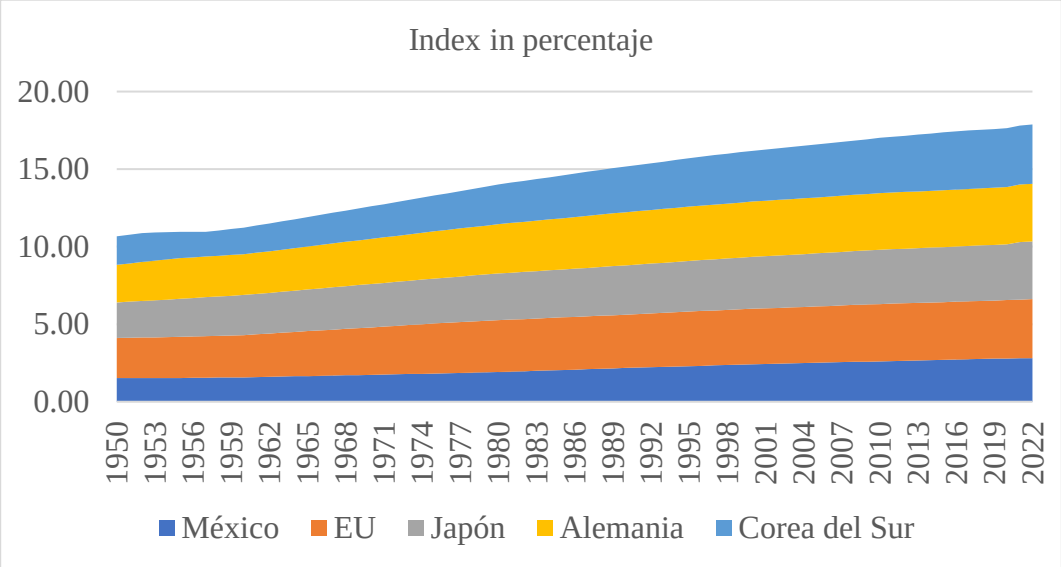
Materials and methods

The methodology used is qualitative, since it reviews various documents related to the line of research on public spending for the formation of human capital, and uses mainly descriptive statistics. The data comes from sources such as the OECD, the Commission for Latin America (ECLAC) and the Secretariat of Public Education (SEP). The data is published annually.

Results

The effort that governments make to address the human capital development agenda is very important to achieve higher levels of well-being. Figure 1 shows a human capital per capita index, resulting from the average years of schooling (Barro and Lee, 2012), as well as the returns to education in terms of income (Psacharopoulos, 1994). This figure shows the allocations that governments make.

Figure 1. Human capital per capita index for selected countries



Source: Prepared by the authors based on Feenstra, RC, R. Inklaar and MP Timmer (2015).

It is therefore essential that governments make social investments to develop human capital. Table 1 shows three variables correlated among a sample of OECD countries, and which have to do with the situation of young people of university age. Regarding spending on students, the sample reveals wide dispersion, with Mexico being below the average. Regarding the situation of young people without employment, without education and without training, the sample reveals a similar dispersion between countries. Mexico is below the average, but far from Holland, the country with the lowest number of young people in this situation. The GDP expenditure item at the tertiary level also reveals a dispersion between countries. In all cases, Mexico is unfortunately far from the level of the most developed countries.

Table 1. Tertiary level statistics in selected countries in 2020

Countries	Spending on tertiary level students (in USD)	Youth without employment, education or training (in %)	GDP expenditure at tertiary level (in %)
Mexico	7 431	11	0.77
South Korea**	11 287	16.3	0.58
Finland ***	18 129	20.3	1.37
Israel **	12 683	18	0.76
USA*	35 347	9.6	0.89
Germany *	19 608	9.7	1.04
United Kingdom *	29 668	15.0	0.47
France *	18 139	20.1	1.1
Holland*	28 889	5.7	1.3
Japan **	19 504	14.1	0.45
Brazil ***	14 325	29.1	1.05
Average	19 546	15	1
Standard deviation	8 560	7	0

Source: Prepared by the authors based on OECD statistics.

Note: The classification criteria have to do with the beginning of the takeoff they have had over time. In this case it is the following:

* Developed countries after the Industrial Revolution, 19th and 20th centuries.

**Developed countries after the postwar period.

***Countries developed since the technological and industrial revolution that began in the 1970s.

Mexico has been a member of the OECD since 1994 and it should be noted that it has made significant efforts to improve the quality, coverage and allocation of public spending. However, it is still far from the size of the investments made by other countries in the aforementioned organization. The current and future production challenges require attention, so it is necessary to prepare the necessary cadres of technicians and professionals to take on these challenges. It is necessary to train active workers and those who will join the productive system in a context of demanding requirements for profiles of new general and specific skills and abilities. On the other hand, higher education in all disciplines tends to increase its spending, which makes it difficult to create public universities, or for these institutions to significantly increase their offer of professions.

It cannot be underestimated that in most countries there has been significant growth in enrollment in the period 1980-2020, derived from making more extensive the opportunities

for access to educational training at all levels and modalities, especially in the country's urban centers. According to the Ministry of Public Education (2020) , what has been achieved in Mexico since the 1980s until the present is an unprecedented change (see table 2). However, the challenge is for more young people to have the opportunity to receive education and training.

In general terms, in the case of Mexico, there is an increasing trend in enrollment in all types of formal education, especially at the secondary and higher levels , whose population ranges between 15 and 23 years old (Secretaría de Educación Pública, 2020). However, crucial issues remain pending, such as the need to expand coverage in tertiary education, especially in rural areas. This gap implies high opportunity costs, evidencing the existence of a gap in Mexico's competitive capacity with respect to developed Western nations. To close this gap, it is also necessary to create conditions for the formation of companies that mean growth in jobs in terms of remuneration (Martínez Chapa, 2019).

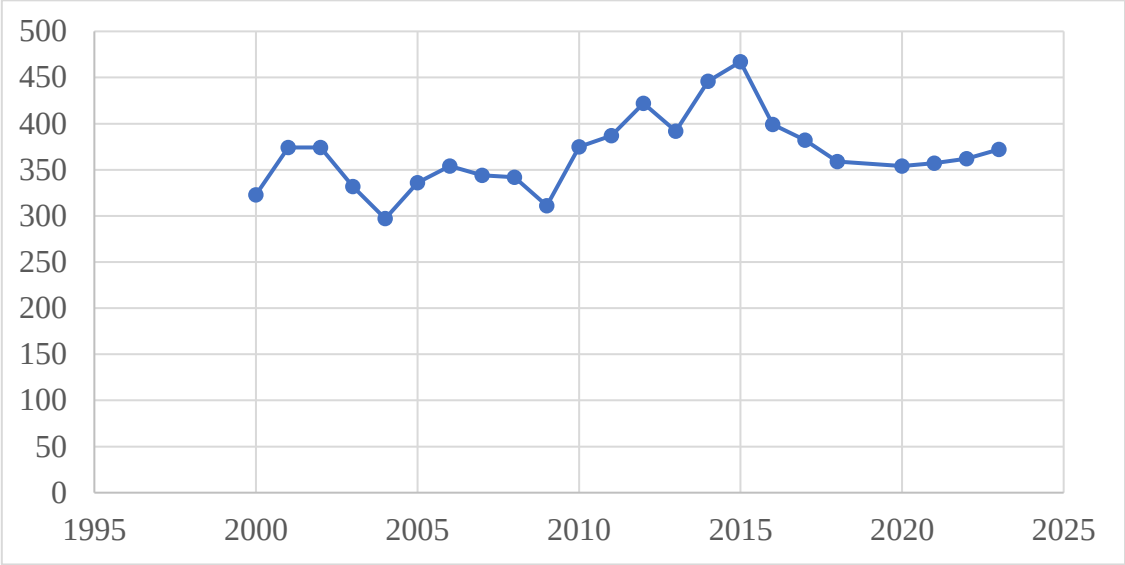
Table 2. Enrollment in the Mexican educational system in the period 1980-2020

Year	Ed. preschool	Ed. primary	Ed. secondary	Ed. high school	Ed. superior	Total
1980	1 071 600	14 666 257	3 033 856	1 388 132	935 789	21 095 634
1990	2 734 100	14 401 558	4 190 190	2 100 520	1 252 027	24 678 425
2000	3 423 600	14 792 528	5 349 659	2 955 785	2 047 895	28 559 400
2010	4 641 060	14 887 845	6 137 546	4 187 528	2 981 313	29 853 979
2020	4 328 088	13 677 465	6 394 720	4 985 005	4 227 477	33 612 855
Rate of change 1980-2020	304%	-7%	111%	259%	352%	59%

Source: Prepared by the authors based on the Ministry of Public Education, 2020

Public spending on education at the citizen level registered a modest growth until 2015. However, after this year a significant decrease can be seen (see figure 2). The challenge is to increase spending in this area, as this means that more young people have access to educational institutions and opportunities for better-paid jobs.

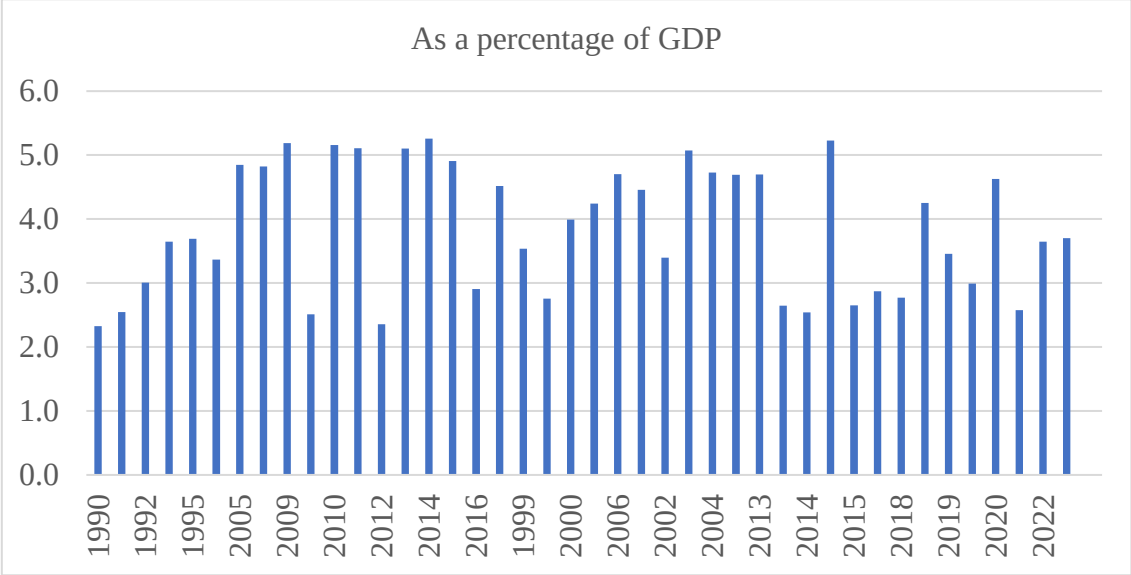
Figure 2. Public spending per capita on education in Mexico in dollars 2000-2023



Source: ECLAC Statistics, 2023.

As regards public spending as a percentage of GDP, Figure 3 shows how this variable has behaved from 1990 to the present. In just over 30 years, growth has gone from 2.4 to 3.7, which shows that, although this spending has increased, what various Mexican government administrations have done is clearly insufficient in view of the needs that this area presents.

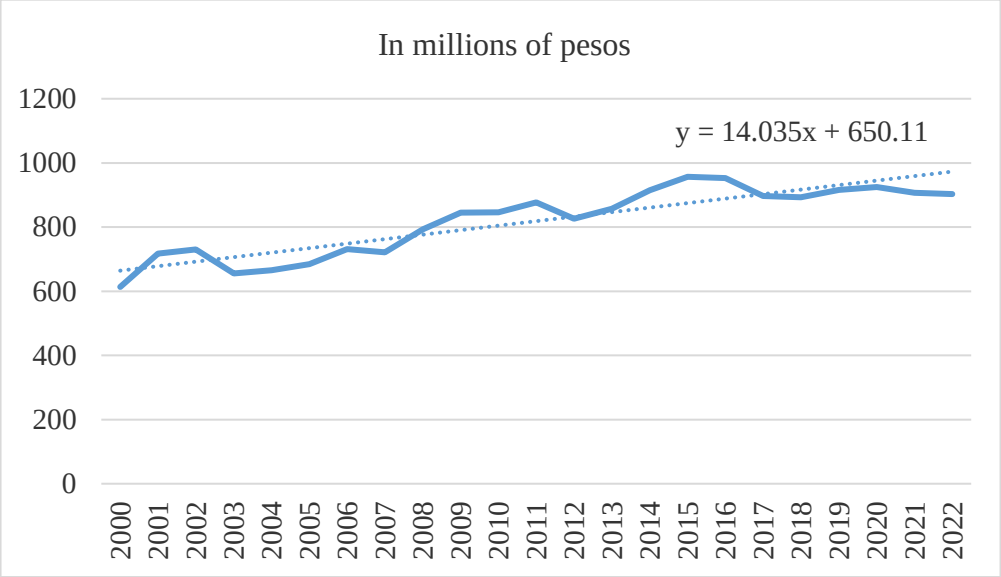
Figure 3. Public spending on education in Mexico 1990-2023



Source: ECLAC Statistics, 2023.

Spending on education in Mexico generally shows a pattern of growth. This is the case until a process of stagnation is observed from 2016 onwards, according to figure 4. Austerity in educational spending means fewer opportunities to invest in expanding the educational offer, but also fewer resources to improve teachers' salaries, as well as to modernize school facilities and their respective equipment, with which students can carry out their practices and experiments.

Figure 4. Public education spending in Mexico 2000-2022



Source: Prepared by the authors based on the OECD.

Discussion

is undeniable. Today's society has greater opportunities for learning and developing work skills. New generations have access to a valuable wealth of knowledge, skills and experiences to perform their jobs. In this sense, it is essential for Mexico to design policies to develop science and technology with its own stamp. The country must make significant efforts to overcome the gaps in coverage, quality, relevance and scope in order to close the gap with more developed economies (Martínez Chapa, 2019).

This research highlights the differences in spending as a percentage of GDP allocated to education in various countries, including Mexico. This reveals the disparity in access to financial resources, as well as to the benefits of development. In the western part of the world, greater funds are allocated to increase the economic returns of education, science and technology. In fact, for a long time, society has relied on these areas because they are

considered a way to achieve greater social mobility. Lozano**,** Amador and Raluy (2021) describe how this type of investment is relevant in the knowledge society, since for organizations the achievement of their objectives becomes crucial once their workforce becomes more efficient.

In the international context, it can be observed that among the countries that make up the OECD, a high school diploma is considered the minimum necessary to enter the productive sector. In public and private organizations in Mexico, a higher level of formal schooling is required as a way to be employed. Therefore, the challenge is to attend to the large strata of the population. In this sense, it is not idle to ask what to do with more than 5.5 million migrant agricultural laborers, among whom a huge contingent is made up of children and young people of school age who are forced to work in very adverse conditions. Another challenge, no less important, is that related to the future of the thousands of students rejected from high schools and universities who do not have the resources to pay for their education in private schools.

The existence of disparities related to formal education shows the unequal allocation of global spending on this, according to the criteria of different regions and countries. The block of nations with the highest level of development in terms of living standards is made up of North America and Western Europe, as they concentrate less of the world's school-age population (from primary to tertiary level), given that they alone constitute just over half of total global spending on education.

Conclusions

This paper has highlighted the importance of increasing investment levels in formal education. It has also argued that education is essential for workers to have more resources for better performance in organizations. There is a positive relationship between human capital development and economic growth, which is evident among nations that foster such a dynamic. The experience of the OECD nations with higher levels of well-being reveals the need for governments to be proactive in the agenda of investment in human capital, and education in particular.

In order to achieve higher levels of education, it is essential to increase public spending, since this is expected to generate conditions for social mobility. In addition, other investments are required, such as infrastructure. Nations need to update their stock of knowledge, experience, skills and innovations.

It should be noted that the current situation in Mexico is suitable for the participation of companies, which should focus on emerging sectors that require urgent attention, such as energy generation, water management, urban sustainability, technological innovation, the need for modern infrastructure and others, all of which are necessary for the present and the immediate future.

Greater resources must be allocated to the formation of human capital, but it is also necessary that the structural reforms implemented in Mexico—labor, energy, fiscal, educational, among others—contribute to overcoming economic stagnation and the loss of competitiveness in important sectors of the economy.

Based on OECD data, there are very clear patterns: countries with higher levels of well-being allocate larger budgets to education because they get more out of it. Countries with fewer resources to invest in education, as well as other aspects of social spending, thus limit their current economic performance, compromising their near future.

As part of what is recommended for Mexico, it must be said that the government is obliged to act on the basis of an educational reform that must also consider the aspects of coverage, attention to the gap, quality, relevance and modernization. This is essential in order to promote the efficient participation of the Mexican economy with greater added value, since it is absurd to try to achieve world-class competitiveness levels based on cheap inputs and a cheap and moderately prepared workforce.

Future lines of research

Finally, it should be noted that this topic is relevant for working on future lines of research, since the formation of human capital is crucial to boost economic growth and development through science, technology and innovation. Nations must be competitive in order to attract national and foreign investment. The formation of companies is crucial for the generation of jobs and income for families. It should be noted that subsidies for human capital and education in particular have been implemented for decades. Mexico has also made such investments, although with insufficient budgets compared to other OECD countries. The returns on such investments are positive by nature. At present, the challenges are not minor, given that it is necessary to address various material and social problems, such as access to water, energy, food production, waste management and sustainable development, in addition to investments in health, education, roads and other necessities.

It would be very useful to explore in further research how countries such as the Nordic countries, Japan, South Korea, Singapore, among others, have reached higher stages of growth and development, which have made considerable investments in the formation of human capital. In fact, other institutional arrangements have been incorporated into the respective government policies of these countries. Other research to be explored is that which has to do with human capital endowments and prospective studies at the level of federal entities and regions in Mexico.

References

Acevedo, A. F. (2018). La teoría del capital humano, revalorización de la educación: análisis, evolución y críticas de sus postulados. *Revista Reflexiones y Saberes*, 5(8), 58-72. Recuperado de https://revistavirtual.ucn.edu.co/index.php/RevistaRyS/article/view/971

Agasisti, T. (2014). The Efficiency of Public Spending on Education: an empirical comparison of EU countries. *European Journal of Education, 49*(4), 543–557. Recuperado de https://www.jstor.org/stable/26609241

Barro, R. y J. Lee (2013). A new data set of educational attainment in the world, 1950-2010, *Journal of Development Economics,* Elsevier, vol. 104(C). Recuperado de https://www.sciencedirect.com/science/article/abs/pii/S0304387812000855

Carnerio, P. K. Hansen y J. Heckman (2003). Estimating distributions of treatment effects with an application to the returns of schooling and measurement of the effects of uncertainty of college choice. *NBER working Paper*, # 9546, Cambridge, Massachusetts, USA. Recuperado de https://docs.iza.org/dp767.pdf

Contreras, A., López, L. P., y Jiménez, A. (2022). Evolución del gasto público del sector educativo de México. *Vinculatégica EFAN*, *7*(2), 260–273. DOI: 10.29105/vtga7.1-100

Comisión Económica para América Latina (2023). Estadísticas de gasto público en educación en México.

Díaz-Bautista, A. y M. Díaz (2003). "Capital humano y crecimiento económico en México". *Comercio Exterior*, Vol. 53, número 11.

Dufrechou, P. (2016). The Efficiency of public education spending in Latin America: A comparison to high-income countries. *International Journal Education Development*,

Vol. 49, pp. 188-203. Recuperado de https://www.sciencedirect.com/science/article/abs/pii/S0738059316300281

Feenstra, Robert C., Robert Inklaar y Marcel P. Timmer (2015), The Next Generation of the Penn World Table. *American Economic Review*, 105(10), 3150-3182. Recuperado de https://www.aeaweb.org/articles/pdf/doi/10.1257/aer.20130954

Hojo, M. (2003). An Indirect effect education on growth. Economics Letters. Volume 80, pp.31-34. Recuperado de https://www.sciencedirect.com/science/article/abs/pii/S0165176503000223

Iglesias, A. e I. Neira (1996). Un análisis internacional del gasto público en educación. *Economic Development* 12. University of Santiago de Compostela. Faculty of Economics and Business. Econometrics. Recuperado de https://ideas.repec.org/p/eaa/ecodev/12.html

Islam, N. (1998). Growth Empirics: A Panel Data Approach -- A Reply. *The Quarterly Journal of Economics*, *113*(1), 325–329. Recuperado de http://www.jstor.org/stable/2586994

Knowles, S. y D. Owen (1995). Wealth capital and cross-country variation in income per capita in the Mankiw- Romer-Weil Model. *Economics Letters*, vol. 48, Nº 1, Holland: Elsevier, pp. 99-106. Recuperado de https://ideas.repec.org/a/eee/ecolet/v48y1995i1p99-106.html

Lozano, R., Amador, M., y Raluy, M. (2021). Modelo de gestión de capital humano por competencias para universidades públicas en México. *RIDE Revista Iberoamericana Para La Investigación Y El Desarrollo Educativo*, *12*(23). DOI: 10.23913/ride.v12i23.1107

Martínez, O. (2019). El papel del conocimiento en las organizaciones productivas: Aspectos teóricos y reflexiones. *RIDE Revista Iberoamericana para la Investigación y el Desarrollo Educativo*, 9(18), 412 - 422. DOI: 10.23913/ride.v9i18.430

Martínez, O. (2021). Los valores éticos y la agenda del desarrollo: algunas consideraciones para la formación educativa. *RIDE Revista Iberoamericana para la Investigación y el Desarrollo Educativo*, *11*(22). DOI: 10.23913/ride.v11i22.900

Organización para la Cooperación y el Desarrollo Económico (2022). *Spending on tertiary education indicators.* Documento. Recuperado de https://www.oecd.org/en/data/indicators/spending-on-tertiary-education.html

Psacharopoulos, G. (1994). Returns to investment in education: A global update. *World development*, 22(9), 1325-1343. doi: 10.1016/0305-750X(94)90007-8. Recuperado de https://www.sciencedirect.com/science/article/abs/pii/0305750X94900078

Ray, D. (2002). *Economía del desarrollo*. España: Antoni Bosch Editores.

Temple, J. (1998). A Positive effect of human capital. *Economics Letters, Elsevier*, 65. Recuperado de https://www.sciencedirect.com/science/article/abs/pii/S0165176599001202

Secretaria de Educación Pública. Estadísticas del sistema educativo mexicano en el periodo 1980-2020. Documento. México

Vecino, F. y A. Zaldívar (2016). El capital humano en la transformación de la estructura y superestructura social. *Dilemas Contemporáneos*, Año 4, publicación número 1., articulo 40. Recuperado de https://dilemascontemporaneoseducacionpoliticayvalores.com/index.php/dilemas/article/view/185/692

Contribution Role	Author(s)
Conceptualization	Oshiel Martínez Chapa “Principal” and Jaime G. Malacara Navejar “who supports”
Methodology	Oshiel Martínez Chapa “Principal” and Jaime G. Malacara Navejar “who supports”
Software	Oshiel Martínez Chapa “Principal” and Jaime G. Malacara Navejar “who supports”
Validation	Oshiel Martínez Chapa “Principal” and Jaime G. Malacara Navejar “who supports”
Formal Analysis	Oshiel Martínez Chapa “Principal” and Jaime G. Malacara Navejar “who supports”
Investigation	Oshiel Martínez Chapa “ Principal” and Jaime G. Malacara Navejar “who supports”
Resources	Oshiel Martínez Chapa “ Principal ” and Jaime G. Malacara Navejar “who supports”
Data curation	Oshiel Martínez Chapa “Principal” and Jaime G. Malacara Navejar “who supports”
Writing - Preparing the original draft	Oshiel Martínez Chapa “Principal” and Jaime G. Malacara Navejar “who supports”
Writing - Review and editing	Oshiel Martínez Chapa “Principal” and Jaime G. Malacara Navejar “who supports”
Display	Oshiel Martínez Chapa “Principal” and Jaime G. Malacara Navejar “who supports”
Supervision	Oshiel Martínez Chapa “ Principal” and Jaime G. Malacara Navejar “who supports”
Project Management	Oshiel Martínez Chapa “Principal” and Jaime G. Malacara Navejar “who supports”
Acquisition of funds	Oshiel Martínez Chapa “ Principal” and Jaime G. Malacara Navejar “Who supports”