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Educating to innovate: designing public policies aligned with sustainable development goals (SDGs) in Guanajuato State

Educación para la innovación: diseño de una política pública alineada a los objetivos de desarrollo sostenible (ODS) en el estado de Guanajuato

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Abstract

A documentary research is presented that has the purpose of explaining the relationship that exists among the educational systems of a region, with the development of a regional innovation and entrepreneurship ecosystem, in order to propose guidelines in public policy that affect the achievement of the Sustainable Development Goals (SDGs) related to Quality Education (SDG 4) as well as Industry, Innovation and Infrastructure (SDG 9). The results show that a key indicator related to these two SDG objectives is school dropout; and to the extent that this phenomenon can be reduced, significant progress can be made towards achieving these aspirations expressed from the United Nations (UN). The study focuses on the Guanajuato case study, which is a political demarcation located in the central region of Mexico. Based on a comparative analysis when applying public policies based on flexible education in other regions of Latin America, together with the principles of participatory governance, a possible way to reduce the school dropout rate, which affects the achievement of SDGs 4 and 9, is proposed to achieve a better quality of life in the state of Guanajuato.

Innovation, Quality of life, Flexible education.

Resumen

Se presenta una investigación documental que tiene la finalidad de explicar la relación que existe entre los sistemas educativos de una región, con el desarrollo de un ecosistema de innovación y emprendimiento regional, con la finalidad de proponer lineamientos en política pública que incidan en el logro de los Objetivos de Desarrollo Sustentable (ODS) relativos a Educación de Calidad (ODS 4) así como Industria, Innovación e Infraestructura (ODS 9). Los resultados muestran que un indicador clave relacionado con estos dos objetivos ODS, es el abandono escolar; y en la medida que pueda abatirse este fenómeno, se podrá tener un avance significativo para el logro de estos anhelos plasmados desde la Organización de las Naciones Unidas (ONU). El estudio se enfoca en el caso de estudio Guanajuato, el cual es una demarcación política ubicada en la región central de México. A partir de un análisis comparativo al aplicar políticas públicas basadas en educación flexible en otras regiones de Latinoamérica, en conjunto con los principios de gobernanza participativa, se propone un camino posible para abatir el índice de abandono escolar, que incida en el logro de los ODS 4 y 9, para alcanzar una mejor calidad de vida en el estado de Guanajuato.

Innovación, Calidad de vida, Educación flexible

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Introduction

Since 2015, the design of national public policies has had a reference point called the Sustainable Development Goals (SDGs), which are a series of global guidelines and aspirations, which were agreed by 193 heads of state and government and approved at the LXX General Assembly of the United Nations, held in September 2015. In general terms, these goals integrate three major dimensions of sustainable development: economic, social and environmental (Gómez, 2018). These goals have been organised into 17 specific aspects, which are: 1) End poverty; 2) Zero hunger; 3) Health and well-being; 4) Quality education; 5) Gender equality; 6) Clean water and sanitation; 7) Affordable and clean energy; 8) Decent work and economic growth; 9) Industry, innovation and infrastructure; 10) Reducing inequalities; 11) Sustainable cities and communities; 12) Responsible production and consumption; 13) Climate action; 14) Undersea life; 15) Life of terrestrial ecosystems; 16) Peace, justice and strong institutions; 17) Partnerships to achieve the goals.

This study is based on goals 4 and 9 of these SDGs, with a view to the 2030 agenda, which have been defined as follows: Goal 4) Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Goal 9) Build resilient infrastructure, promote sustainable industrialisation and foster innovation. (United Nations, 2018).

Beginning the analysis of this study, we can identify that what is indicated by SDG 4 is an old desire already considered in the laws of Mexico, due to the fact that access to education is a fundamental Human Right that all States must ensure to their population. Article 3 of the Political Constitution of the United Mexican States establishes the regulations to guarantee early childhood, preschool, primary, primary, secondary, upper secondary and higher education (Constitución Política de los Estados Unidos Mexicanos, 2019). Due to this foundation, it is expected that the different governmental bodies, at federal, state and municipal levels, establish the conditions for the entire population to access the different educational levels that correspond to them, according to their age and intellectual development.

However, in Mexico and in the political demarcation of Guanajuato, there is still much to be done to establish the conditions that will allow the entire population to have the opportunity to access quality education. A study conducted in 2018 by the Colegio de México identifies an educational backwardness of 43% in the National Education System. This is characterised as follows: 5.4 million Mexicans are illiterate (cannot write or read an errand); 10.1 million Mexicans did not manage to finish primary school; and 16.4 million did not finish secondary school. This gives us a total of 31.9 million Mexicans with some kind of educational deficiency, which represents 43% of the population of 74 million Mexicans between 15 and 64 years of age (Gil-Antón, 2018).

Diagnosis to understand the current problem

Access to quality education and regional socio-economic development have always been closely related (Rosaldo and Castaño, 2015). Major global economies are associated with inclusive and consolidated education systems. One way to measure inclusive access to quality education is through an indicator called "Educational Attainment" (LE), which measures the number of students who complete their university education based on 100 students who start their primary education, for the same generational cohort (Ramírez and Hernández, 2012). In turn, an indicator that measures the degree of economic development of a region is determined by its Gross Domestic Product (GDP), which is a macroeconomic variable that expresses the monetary value of the sum of all the production of goods and services that are developed in a country or region during a year. From the definition of these concepts, a close correlation has been identified between the GDP of a region and the "Educational Attainment" indicator (Coleman, 1988).

Applying this theoretical postulate of correlation between LE and GDP, now for the context of Mexico, Graph 1 is presented in the first instance, which shows the LE indicator for each of the states.

Educational Attainment (LE) indicators by state in Mexico, for the school year 2020-2021.

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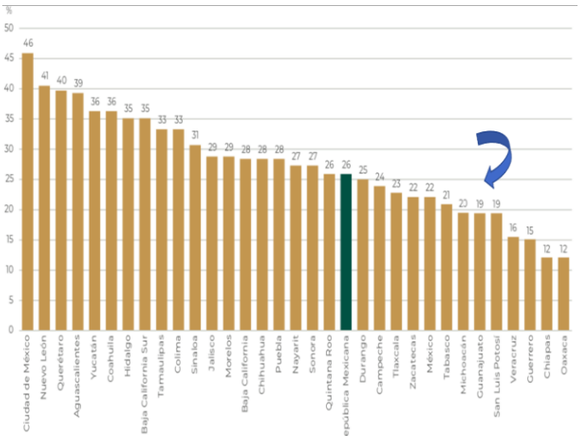
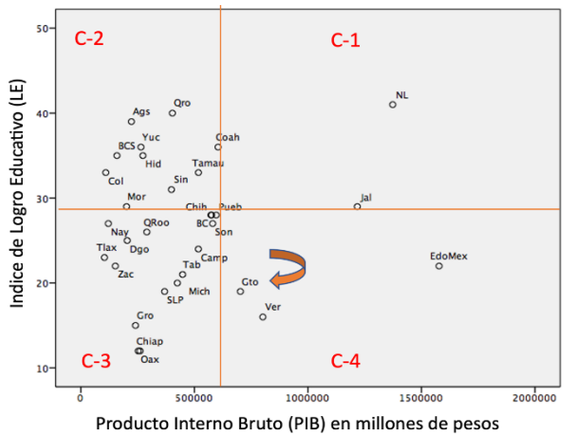


Graphic 1
Source: Ministry of Public Education (2021)



Graphic 2
Source: Own elaboration with data from the Ministry of Public Education (2021) and the National Institute of Statistics and Geography (2021).

A first striking fact is that the highest positions in the PE indicator are mostly associated with states with high economic development, such as Mexico City, Nuevo León, Querétaro and Aguascalientes, the latter two with a large presence of industries belonging to the automotive and aerospace sector.

However, Guanajuato's position in this graph 1 is surprising, as the state LE is only 19 (number of students per 100 who complete their university education for the same generational cohort). Additionally, it can be observed in the same graph that this indicator in Guanajuato is far below the national average LE of 26 students, as shown in Graph 1.

In order to analyse this fact in detail, we now proceed to elaborate a scatter diagram of points, presented as graph 2, where the "X" axis represents the GDP in millions of pesos and the "Y" axis shows the Educational Attainment (LE) indicator. Each point in graph 2 represents the location of a state with respect to its GDP on the "X" axis and its LE proportionally on the "Y" axis.

Gross Domestic Product (GDP) vs. Educational Attainment (LE) by state.

Additionally, in order to identify the points that deviate from a possible direct correlation as established by Coleman (2018), Graph 2 is segmented into four quadrants, following the methodology of Estepa (2008), where the points or entities in quadrant 1 represent the states with high GDP indicators and a high LE, i.e. they follow the theoretical trends referred to above. In this quadrant 1 are the states of Jalisco (Jal), Nuevo León (NL) and Mexico City (not plotted for scale reasons). Quadrant 3, on the other hand, integrates the states with comparatively low GDP indicators and lower LE levels, which follow the direct correlation trends. For this analysis, quadrant 3 includes the states of Puebla (Puebla), Chihuahua (Chihuahua), Baja California (BC), Sonora (Son), Quintana Roo (QRoo), Nayarit (Nay), Durango (Dgo), Campeche (Camp), Tlaxcala (Tlax), Zacatecas (Zac), Tabasco (Tab), Michoacán (Mich), San Luis Potosí, (SLP), Guerrero (Gro), Chiapas (Chiap) and Oaxaca (Oax). Quadrant 2 and quadrant 4, integrate points that do not follow these theoretical trends, so that points located in quadrant 2 have retained high LE indices (comparatively) despite not being in the top national GDP rankings. In this quadrant 2 are the entities of Querétaro (Qro), Aguascalientes (Ags), Yucatán (Yuc), Coahuila (Coah), Baja California Sur (BCS), Hidalgo (Hid), Tamaulipas (Tamau), and Sinaloa (Sin). Finally, quadrant 4 shows the most serious situation of all this graphical representation, as this quadrant integrates those states that have high GDP indicators but low LE levels. It is noteworthy that only three states appear in this quadrant: Estado de México (EdoMex), Veracruz (Ver) and Guanajuato (Gto).

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The states located in quadrant 4 are deviations from the general correlation trends. That is, there are conditions in the context of these states, which despite having (comparatively) high levels of GDP, their levels of Educational Achievement (LE) are (comparatively) low. In particular, the state of Guanajuato has one of the highest GDPs in Mexico, ranking 6th out of 32 states (Instituto Nacional de Estadística y Geografía, 2021), but its LE indicator is one of the lowest, ranking 26th out of 32 states (Secretaría de Educación Pública, 2021).

This is evidence that it is necessary to intervene with actions or reinforce public policies at the state level in Guanajuato, to change this LE trend and put it at least above average, achieving an advance from 19, to a higher level of 26 students who finish their university education, for each generational cohort of 100 who started primary school.

The problem of school dropouts

Taking up Gil-Antón's (2018) thesis, which aims to reduce school dropout throughout the entire school career, from primary to higher education, Figure 3 presents an infographic that shows the analysis of the main points where the highest dropout rates have been identified.

Infographic of school dropout by level of education in the national school system. Generational cohort 2004-2020.

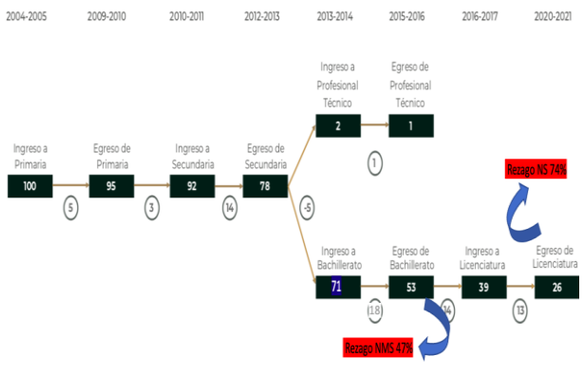

Figure 1
Source: Ministry of Public Education (2021).

Figure 1 shows in the first block a total of 100 pupils entering primary school. The number 5, which appears after this block and enclosed in a small circle, represents the proportion of pupils who for some reason dropped out of primary education, so that in the next block labelled "Primary school leavers" the number 95 appears, which is the proportion of "Educational Attainment" at this first level of education. By successively reviewing the figures presented throughout figure 3, we can identify in the different circled numbers, the proportion of pupils who drop out of education throughout their entire school career.

In Figure 1, two points of particular interest for this analysis have been clearly highlighted, namely the levels of educational lag at the upper secondary level (NMS) and at the tertiary level (NS), which are 47% (cumulative lag) - which is very similar to the 43% percentage of educational lag already described by Gil-Antón (2018) - and 74% (cumulative lag) for NS, ending with an average of only 26 students finishing their university education. This means that, at the national level, in the school-based education system, 47 out of 100 students were not able to complete their NMS education and 74 out of 100 did not finish their NS studies. Thus, it can be stated that approximately only one quarter of this 2004-2020 cohort have completed a bachelor's degree education. Only one quarter, when the Political Constitution of the United Mexican States states that educational opportunities should be for all.

International comparison

A review of this LE indicator in member countries of the Organisation for Economic Co-operation and Development (OECD) shows that Mexico does indeed have a great challenge in this regard, as the LE indicators of some of its trading partners are much higher than those of Mexico. Thus, we can cite some LE indices: Japan 47; Finland 43; United States 42; Switzerland 40; Korea 39 and, in particular, the case of Chile, which has an LE of 42 (OECD, 2021). It is evident that there is a big difference between the LE index of these countries and that of Mexico, which is 26, and the LE index of Guanajuato, which is 19, as shown in Graph 1.

ISSN: 2414-4967

Complexity of the problem of educational backwardness

Although comparisons between GDP and LE in different socio-economic regions allow us to visualise trends and deviations from expected behaviour, LE indices are in turn associated with the development of an innovation and entrepreneurship ecosystem.

In recent years, new methodologies have been developed to identify the causes or main socio-economic variables that drive the efficiency of innovation ecosystems around the world. The World Intellectual Property Organization (WIPO) has developed a system to assess the progress in innovation in 130 countries, and publishes the annual "Global Innovation Index" report, which analyses different variables that have an impact on the innovation ecosystems of these economies. One of the main findings of the WIPO studies (2021) is the strong correlation between the educational attainment index (LE) among the population under 30 years of age who have completed their university education, with the number of patents registered in these countries and the development of innovation processes, mainly in technology-based companies. In addition, this report reports the main countries in Latin America and the Caribbean where significant progress has been made in innovation: 1) Chile, 2) Mexico and 3) Costa Rica (WIPO, 2021).

The location of Chile and Costa Rica within the "Top 3" Latin American countries with the greatest development of their innovation ecosystem is surprising, although this fact is explained by their high indicators of "Educational Achievement", as Chile reports an LE of 42, and Costa Rica an LE of 40 and are the leaders in these indicators in all of Latin America (OECD, 2021) despite the fact that the GDP of these countries is much lower than the GDP of Mexico, which occupies second place in the development of innovation in this Latin American region.

In other words, the development of a country's economic well-being, as well as the growth of its innovation ecosystem, has a complex and multifactorial nature; however, one variable that has a favourable impact on all this socio-economic development is the LE indices achieved by its young population, hence the importance of designing public policies that have an impact on reducing school lag and dropout rates at all educational levels, mainly at the NMS and NS levels.

Origin of the school dropout problema

There are different studies that have identified the causes of school dropout in Guanajuato, although these factors are diverse according to the type of study, educational level or municipality analysed. Sánchez (2015) establishes that failure is the main cause of dropout at the upper secondary level in the state of Guanajuato, leaving in a second order of importance the causes of dropout associated with teacher performance, school support, motivation, teaching and learning strategies, as well as availability of educational offers. Other studies report that lack of resources is the most important reason among higher education students at the Interdisciplinary Professional Unit of Engineering in Guanajuato, belonging to the National Polytechnic Institute (IPN) located in the municipality of Silao (ElSahili, 2011), although the reasons for dropping out of school, later identified by Sánchez (2015), are also recognised as relevant.

Flexible education as an alternative solution

Before reflecting on alternative solutions to this problem, it is important to summarise the causes and consequences of the public problem of school dropout in the state of Guanajuato. Main causes: a) High failure rate, b) Lack of economic support and socio-economic problems, b) Low motivation of students to continue their studies, c) Deficient teaching strategies applied by teachers and d) Scarce educational offer and rigid schooling systems; this is based on the previously consulted research referred to. And the main consequences can be summarised as: a) Slowing down of the social and economic development of the region, b) Possible increase in crime and insecurity rates, and c) Inhibition of the state's innovation and entrepreneurship ecosystem.

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The problem of school dropout is present globally and has particularly increased in the second decade of the 21st century (Soto, 2016). A search in the specialised literature on possible solutions to this problem reveals the emergence of Flexible Education Models as a recurrent solution, mainly in different Latin American countries, which are formal education proposals, but with certain characteristics in their contents and modalities, which allow reaching and retaining diverse student populations or those living in vulnerable conditions, to help them overcome their difficulties in participating in the traditional educational offer.

Considering all of the above, the objective of this essay seeks to answer the question: How can the principle of Flexible Education be implemented in Guanajuato to improve the Educational Achievement (LE) index in order to have a favourable impact on the development of an innovation ecosystem, strengthening the development of scientific and technological capacities of young people in the state?.

In a first approach to flexible education models, two currents can be identified. Those aimed at innovating educational modalities, moving from face-to-face or traditional education to so-called "distance" modalities based on the use of information and communication technologies. Another current in flexible education models is oriented towards revising and adapting traditional curricular content, designed from the perception of disciplinary experts, towards content oriented towards the context and the particular learning interests of students. This last trend is closely related to a new role of the teacher, who moves from a transmitter of information to a facilitator of learning. In particular, this current of flexible education has been successfully implemented in Colombia during the second half of the 20th century (Rios, 2012). This model has been called "Escuela Nueva" and was the basis of the education policy implemented by Colombian President César Augusto Gaviria Trujillo, during his term of office from 1990 to 1994. However, this educational policy was oriented towards primary schools located in rural communities in Colombia, based on the contributions and work carried out in the 1970s by the pedagogues Victoria Colbert and Óscar Mogollón.

Following this same trend of flexible education that Colombia has applied, particularly for its basic education, mostly in rural areas, we can identify the case of the public policies applied in Korea. After having overcome the period of war, which resulted in the separation of North Korea (dictatorship) and South Korea (democratic), the latter country has implemented an education policy that gives priority to the interests and abilities of students, particularly at the EMS and HE levels. However, some studies conclude that the high LE rates and quality of the Korean education system are primarily related to a legacy of the Confucian ethic that is widely recognised in this country, as well as the high social esteem for education (García and Arechavaleta, 2011).

Evaluation of flexible education policies

UNICEF has conducted a very interesting evaluation of the implementation of flexible education models in 4 Latin American countries: El Salvador, Ecuador, Guatemala and Argentina (UNICEF, 2022). It is interesting to analyse that this report clarifies that flexible education models are not proposals based on unique structures, but that each country or region has adapted the philosophy of the educational models to its own educational objectives, as well as its social and economic reality. The main achievements of implementing education policies in these countries are thus described.

El Salvador

The implementation of the flexible education model in this country focused on the following aspects: Virtual modality; Expansion of the offer of educational programmes; Adaptation of the curriculum to the skills and competences required in the region; Training of teachers in the flexible education scheme; Decentralisation of the administration of educational services.

Ecuador

Among the outstanding features is the involvement of community organisations in the implementation of flexible strategies together with educational organisations. An intense programme of teacher training and participation of community organisations, implementing plans to contain school dropout in specific regions.

ISSN: 2414-4967

Guatemala

The flexible modality implemented was oriented to the reincorporation of students who dropped out of primary and secondary education; face-to-face, blended and distance learning modalities; curriculum redesign based on the development of competencies in seven basic areas with a humanistic approach that promotes cultural identity. It is relevant that the teachers who participated in this programme were trained and come from different public, private and NGO sources.

Argentina

Creation of an information system on students who had dropped out of school in order to implement actions to reintegrate them into their educational levels. This Argentinean programme places special emphasis on understanding the reasons for dropping out in order to carry out actions to ensure a successful return; Implementation of different modalities, both face-to-face and distance learning; the Ministry of Education worked with other governmental bodies such as the Ministries of Health, Social Development and other social organisations, to implement actions for the return of students. Despite the progress achieved, this programme did not continue with the change of government in 2019 in some provinces such as Santa Fe, and only the virtual modality has remained.

To summarise these outstanding experiences of flexible educational models in Latin America, we can mention the close cooperation that existed in the implementation of these programmes both between the federal ministries of education in each country and the governmental education bodies in each province. In addition, the participation of non-governmental actors such as private educational organisations, community organisations and civil society organisations (NGOs) has also been identified. The joint work of all these organisations was aimed at recognising that there is a sector that has been excluded from traditional programmes and that the specific causes in each region should be analysed in detail in order to implement differentiated actions.

Another lesson derived from the review of these Latin American cases is related to the recognition that flexible education models can be implemented in parallel to the different schemes of the traditional educational ecosystem, aimed at the recovery of people who have stopped studying, making flexible schemes such as timetables, modalities and curricular contents, which, although inspired by the official programmes of each country, prioritise the development of competences and skills required in their economic and social reality. But, above all, the fundamental element in all these cases is the close articulation between governmental and civil society actors.

Educational governance

The concept of Governance emerged in the academic and political discourse in the last decade of the 20th century and although it has different meanings, for this essay we take the concept of Aguilar (2010) understood as a new way of governing, where the hegemonic power of a single governmental actor is reconsidered, to move towards a form of government based on cooperation between the State and different organisations and actors of civil society, where the State remains the predominant actor but with a balanced interrelation between other actors, whether from the public or private sector. The term Governance has gained special relevance in the 21st century due to the high degree of complexity of the main social problems faced by governments, where the joint participation and collaboration of society and government is required to implement effective public policies. Based on what has been identified in the experiences of flexible educational models in the four countries analysed, it is evident that these have been successful experiences as they have implemented the concept of governance to address the problem of high dropout rates in their countries.

ISSN: 2414-4967

In this way, the problem of educational dropout in Guanajuato can be addressed by reflecting on the fact that the educational trajectories of students in a region can be very different due to the conditions of vulnerability, exclusion and backwardness generated by traditional school structures and processes (González, 2021). As a response to this problem, flexible educational models emerge where flexibility is identified in aspects such as modalities (face-to-face, hybrid or distance); timetables and spaces; curriculum; materials and infrastructure, as well as pedagogical practices. In addition, flexible educational proposals recognise that there are differentiated needs for the development of competences and skills that are useful in the social and economic context where students live. However, the implementation of these models is not an easy task, due to the high complexity involved.

Therefore, the concept of Educational Governance makes sense to address the problem of high dropout rates in Guanajuato, based on the steering role of governmental educational bodies, but with an interrelation and cooperation between different sectors of civil society.

Final reflection by way of recommendation

The guiding thread of this essay has been How can the principle of Flexible Education be implemented in Guanajuato to improve the Educational Achievement (LE) index? Based on the identified causes and consequences of this social problem, as well as on the evaluation of experiences of flexible education models implemented in some Latin American countries, the following aspects can be enunciated that should be considered for a state public policy that addresses this problem:

- The intervention to reduce school dropout in Guanajuato must be a parallel and simultaneous action that is inserted in the different instances and sectors that already operate in the state education system.

- It must consider that there are sectors and groups of students with a high degree of vulnerability, to whom differentiated solutions must be applied over those students who follow stable school trajectories.

- Public policy for the rescue of this vulnerable sector must take into account the concept of governance, in which governmental and civil society actors participate and collaborate.

- Recover the broad proposal of flexible educational models, where modalities, timetables and spaces, curricula, materials and infrastructure, as well as pedagogical practices must be rethought and innovated. The flexibilisation actions for each dimension will be designed with the collaboration of the actors involved and taking into account the particular needs of each region or municipality.

- Clearly establish indicators to evaluate the effectiveness of the intervention in order to decide whether to continue with the intervention or to make adjustments to reduce the factors of exclusion of vulnerable students, which have caused them to leave the state education system..

The current state government implements a series of public policies that have proven to be effective in addressing the problem of school dropout as well as boosting the state innovation ecosystem, such as the scholarship programmes for maintenance, international mobility scholarships, the free allocation of computers to NMS and NS students, delivered by the "Mi Compu" project, as well as the "Valle de la Mentefactura" project that promotes a culture of innovation and entrepreneurship among young people in Guanajuato. All these actions have proven effective and should be continued.

In fact, on 1 June 2022, a collaboration agreement has been signed with the World Bank and UNESCO to reduce the dropout rates reported in this essay. The emergence of COVID-19 in the period from 2020 to 2022 will have an even more negative impact on the measurements of this state issue. This collaboration agreement is a first step towards Education Governance, but agreements with other internal actors directly or indirectly related to education are necessary.

ISSN: 2414-4967

The implementation of an Education Governance must consider the characteristics of the state of Guanajuato such as high industrialisation, but high levels of insecurity, addictions and large educational gaps between the 4 main cities of the industrial corridor (León, Irapuato, Salamanca and Celaya) and the rural communities.

With all these actions, it will be possible to continue implementing a public policy to achieve SDGs 4 and 9 respectively in the state of Guanajuato.

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