

A close-up photograph of a human hand with light skin and manicured nails gently touching a vibrant green, textured surface of moss. The lighting is soft, highlighting the intricate details of the moss and the skin's texture.

# Meio ambiente:

Preservação, saúde  
y sobrevivência 2

Cleiseano Emanuel da Silva Paniagua  
(Organizador)



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## PRESENTACIÓN

El e-book: “Medio Ambiente: Preservación, Salud y Sobrevivência 2” consta de seis capítulos de libros de investigación científica que sacan a la luz la preocupación de la relación hombre-medio ambiente que incrementa la degradación del medio ambiente y sus recursos naturales.

El primer capítulo nos presenta la importancia de desarrollar la conciencia/educación ambiental como una forma de promover una relación más armónica y sostenible con el medio ambiente, garantizando los recursos naturales para las generaciones futuras. El segundo trabajo presenta una reflexión sobre la importancia de la educación ambiental y el saneamiento básico para estudiantes de secundaria de una escuela pública ubicada en la zona rural del municipio de Unaí, en el estado de Minas Gerais - Brasil.

El Capítulo 3 presentó un estudio con el fin de investigar el poder calorífico superior e inferior generado a partir de los residuos sólidos urbanos (RSU). Los resultados mostraron que el uso de energía es representativo y recomendado para generar energía en ciudades con poca población. El Capítulo 4 investigó el uso de nanopartículas magnéticas asociadas con coagulantes orgánicos e inorgánicos. Los resultados mostraron que el uso de coagulante a partir de semillas de *Moringa oleifera* presentó una remoción del 99,85% luego del proceso de filtración aplicado al efluente galvánico.

Finalmente, el capítulo 5 presenta un trabajo que investigó la estructura poblacional y ecológica de la especie de *Polylepis rugulosa* en la región del Perú. Los resultados mostraron que la etapa de plántula es más alta que la etapa adulta. La especie de *P. rugulosa* tiene una densidad menor que las otras especies en los bosques de Quenoa en Perú y Colombia. En el capítulo 6 se estudió el banco de fragmentos de bosque y estrato herbáceo-subarbusto en la ciudad de Sorocaba (SP), lo que resultó en baja riqueza y densidad de plántulas de especies arbóreas, actuando como indicador de fragilidad.

En esa perspectiva, la Editora Atena viene trabajando para estimular y animar a cada vez más investigadores de Brasil y de otros países a publicar sus trabajos con garantía de calidad y excelencia en forma de libros, capítulos de libros y artículos científicos.

Cleiseano Emanuel da Silva Paniagua



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## ENVIRONMENTAL EDUCATION FOR DWELLING AS A SUSTAINABLE UNIT

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**ABSTRACT:** Climate change affects the availability of water in housing, this phenomenon is lived largely by environmental variations in the world, and in Mexico given its location in the tropic of cancer, it is exacerbated by contrasting variations that decrease or increase rainfall. There is a decrease in the average annual rainfall recorded of 742.2 mm in the period from 1941 to 2018 (CONAGUA, 2020), for 2019 it was reduced by 3.2%, 2.7% in 2020 however for 2021, it had an increase of 3.68%, however despite the increase, currently in 2022, urban social housing suffers from water scarcity, generated both by the lack of capacity of the infrastructure of the Cutzamala system as well as the increase in real estate developments. This shortage in housing in a governmental way has the emerging water supply program, however, given that this affects 4,568,635 of the homes in Mexico City (INEGI, 2020), it seeks to know how it is feasible to strengthen an environmental education that promotes the implementation of ecotechnics for the recycling of gray and rainwater, will improve

the efficiency of this resource and contribute to generating a sustainable culture. How it is possible for the inhabitants of urban social housing to be reconfigured from a **sustainable education as actors that promote the application of technologies that contribute to a conscious and optimal consumption of water?** To do this, we started from a quantitative cross-sectional observational exploratory diagnosis to a random sample of 113 people from ten municipalities that attend CECYT 2 in the CDMX, with a closed questionnaire of 20 items, from the use of water in the sample under study, from knowing their perception regarding the provision of water, if they carry out any type of rainwater collection as well as reuse of gray water derived from washing clothes, as well as their willingness to learn the use of ecotechnics. According to the exploratory study, which integrates housing of 10 municipalities of the metropolitan area of the Valley of Mexico (ZMVM), 75.2% consider having a relatively sufficient supply of water, 8.5% carry out water collection actions and 17.1% reuse the waste water from washing. Regarding their willingness to learn economic strategies on how to contribute to mitigating climate change with a rational and optimal consumption of water, 70.9% are willing to implement water recycling ecotechniques. The use of natural resources has been a daily occurrence in housing and often does not reflect on its efficiency, however, when raising the possibility of implementing environmental and sustainable education strategies, learning how to make better use of natural resources in housing, of which respondents express their availability and reflect on the impact of their own housing to

the common benefit in the environmental field, economic and social and contribute to climate change mitigation.

**KEYWORDS:** Dwelling; eco-techniques; water; climate change, education.

## INTRODUCTION

The relationship between sustainable housing and environmental education, starts from the premise that every human being requires a space of life and coexistence that allows him to satisfy his security needs, as Maslow raised or existence as Alderfer establishes in his theory of human motivation . (Turienzo, 2016). On the other hand, article 25 of the Universal Declaration of Human Rights (UN, 1948) establishes the right to housing as one of the conditions for everyone to enjoy a standard of living adequate for health, well-being for himself and his family, as well as the Political Constitution of the United Mexican States, in its 4<sup>th</sup> article, states that “every family has the right to enjoy decent and decent housing and the right to domestic consumption of sufficient, safe, acceptable and affordable water and sanitation”. (Federal Government, 2021)

Taking into account the importance of housing for every human being, it is proposed through environmental education contextualized to habits in housing, to promote a sustainable culture that conceives the first habitat in which it interacts, from learning strategies that allow it to apply passive systems that optimize the use of natural resources such as water, energy and soil contribute to reducing their impact on the environment, promote significant savings in their consumption and generate sustainable habits in all members of the family, that is, the family is configured in a force that socializes its ideas and promotes the responsible use of land, air, energy and water resources. (García López, 2017)

## THEORETICAL FRAMEWORK

Sustainable development, according to the Brundtland Report, implies being able to meet the needs of present generations, without compromising the needs of future generations. (UNESCO, 1987). It seeks from a global approach, to generate strategies to conserve life on the planet, however, in today’s societies that live various political, economic, and social crises, the global guidelines towards sustainable development have not had the expected impact.

Influencing the resolution of environmental problems through education is an approach that has been proposed since the conferences organized by UNESCO, from 1972 to 2015, in which various alternatives have been proposed to incorporate sustainable development in the educational training of the entire population (see illustration 1) as well as various experiences that have occurred in isolation at various educational levels around the world.

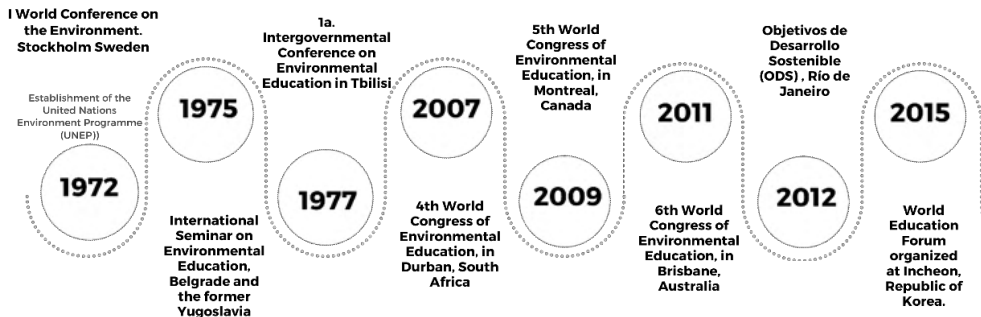


Figure 1. Evolution of Sustainable Education. Own elaboration with data obtained in UNESCO reports

Derived from the sustainable development goals at the 2015 World Education Forum, which states that Sustainable Development begins with education as the center of it and represents a recommended strategy towards the achievement of the Sustainable Development Goals (SDGs) as a path to a dignified life for all. In a particular way towards reducing poverty, health and climate change, thus establishing that:

“Education increases environmental awareness and concern, and equips people with the skills and values to change behavior and find solutions to environmental challenges (SDG 12-15)” (UNESCO, 2015)

The challenges posed by education for sustainable development are based on its analysis in the economic, social, and environmental spheres, these are defined according to the 2030 Agenda for Sustainable Development of the United Nations that established 17 objectives that seek to guarantee a sustainable, peaceful, prosperous, and just life for all, now and in the future. They represent challenges to achieve the survival of humanity from environmental limits, climate change and the urgent protection of the environment, critical thresholds in the use of natural resources, the eradication of poverty and the promotion of economic development. (UNESCO, 2017)

For humanity to survive from environmental limits, they encompass the use of natural resources, eradicating poverty and promoting economic development among others. These are directly interrelated with addressing social needs such as education, health, social protection, job opportunities.

UNESCO establishes for the achievement of these objectives to promote, based on the commitment of education, the construction of strategies that provoke the subject to assume conscious decisions, generate habits to act responsibly in environmental, social and even economic fields, as well as to generate sustainable lifestyles, which start from respect for human rights, gender equality, culture of peace and non-violence, cultural diversity.

Specifically, in number 4 SDG, it is defined as providing quality education, focused on seven goals, limiting the characteristics of the expected results of each of them. See Table 1

<b>Goal 4. Quality Education 2030</b>	
<b>Particular goals</b>	<b>Characteristics</b>
4.1 Universal primary and secondary education	Free, equitable and quality, with relevant and effective school outcomes
4.2 Early childhood development and universal pre-school education	Access to early childhood care and development services. ("Early Childhood Care and Education - UNESCO") With quality, and prepared for primary education
4.3 Equal access to technical/ vocational and higher education	Equal and quality access for all men and women ("SDG4: Education   Global Education Monitoring Report - UNESCO")
4.4 Skills suitable for decent work	Increase young people and adults with technical and professional skills necessary to access employment and entrepreneurship
4.5 Gender equality and inclusion	Guarantee equal access to education. (Vulnerable, disabled, indigenous) at all levels of vocational education and training
4.6 Universal youth literacy	"Ensure that all young people and at least a substantial proportion of adults, both men and women, have literacy and numeracy skills" ("SDG No. 4: Education")
4.7 Citizenship education for sustainable development	Ensure the necessary skills and practical knowledge to promote sustainable development, through education for sustainable development and the <b>adoption of sustainable lifestyles</b> , human rights, gender equality, the promotion of a culture of peace and non-violence, global citizenship and the appreciation of cultural diversity and the contribution of culture to sustainable development, among other means ("Institutional Strategic Plan 2019-2024 - UNESCO")

Table 1. Target 4 Quality Education 2030

Source. UNESCO, 2015. World Education Forum 2015, Paris: UNESCO.

Derived from these works, three ways of carrying out are proposed, and part of the effective learning environments, which establish as school facilities and environments that respond to the needs of students, inclusive by gender and capacity, as well as safe. It integrates the increase of scholarships available in more unprotected countries for professional, technical, scientific, engineering training, as well as in ICT. On the other hand, it focuses on strengthening teacher training based on international cooperation.

On the other hand, climate change according to article 1, section 2 of the report of the UNFCCC (UNESCO, 1992), establishes it as that which is generated directly or indirectly by the activity of the human being, which disturbs the composition of the atmosphere and contributes to the natural variation of the climate. These elements that interact in climate change that are observed in Table 2 and that are integrated into the scope of housing and its surroundings.



Nomenclature	Concept	Integrates
SC	Climate System	Atmosphere, hydrosphere, biosphere geosphere and interactions.
E	Emissions	GHG release /set period
GEI	Greenhouse gases	Natural and anthropogenic components that absorb and re-emit infrared radiation
D	Deposit	Component of the SC that stores GHGs or some precursor
S	Sink	Process, activity, or mechanism that absorbs GHG from the atmosphere
F	Fuente	Process, activity, or mechanism that releases GHG into the atmosphere

Table 2. Elements that interact in climate change.

Source Framework Convention on Climate Change UNESCO, 1992.

Thus, climate change caused by the increase in CO<sub>2</sub> emissions, product of the indiscriminate use of fossil fuels, as well as the uncontrolled felling of trees, increases global temperature, sea level and melting in the Arctic, causes droughts and floods, sea level rise, as well as intense meteorological phenomena such as storms and hurricanes. These disturbances **affect rainfall, decreasing the levels in the dams that provide water to cities, affecting the endowment of this resource.**

Climate change continues to increase and it is necessary to reflect that in Mexico in housing are generated in the residential area 21,460 tons of CO<sub>2</sub> considered 0.19 per inhabitant, that is, 4.3% of total emissions (Cruz Islas, 2016) that are emitted 439 MTCO<sub>2</sub> (*Metric tons of carbon dioxide*), with a population of 126'014, 024 inhabitants, which live in 35,219,141 housing, and in the CDMX with 16'492,318 inhabitants and 4'568,635 dwellings, with a density of 3.3 inhabitants per dwelling. (INEGI, 2020)

The average annual natural availability index in Mexico in 1955 was 11,500 m<sup>3</sup> 7 inhabitant, decreasing for 2016 to 451.6 km<sup>3</sup>, which is made up of 80% of surface runoff and 20% of aquifer recharge, this represents in a particular way for the ZMVM in 2017 an average natural availability of 3,427 liters, with 144 m<sup>3</sup> per inhabitant per year, being the lowest in the country. (SEMARNAT, 2021)

Sustainable Architecture states that a sustainable home must include aspects of bioclimatic design and energy efficiency, as well as the reduction of the carbon footprint in its life cycle, (SEMARNAT, 2009), and focus to a greater extent on financial elements of buildings. Housing is conceived as the space that people and families inhabit, either in the countryside or in the city used to inhabit (Government of Mexico, 2019) and a habitable dwelling such as one that guarantees the physical safety of its inhabitants and provides them with sufficient space, as well as protection against the cold, humidity, heat, rain, wind and other health risks and structural hazards, however in this same document the term sustainable housing is only mentioned once.

According to the projections of the National Council for Housing, (CONAVI) in 2008, establishes that by 2030 there will be 45 million households and the Housing Law indicates that the actions must constitute a “factor of environmental sustainability, territorial planning and urban development” (SEMARNAT, 2009)

The concept of healthy housing was coined in 2006 by the World Health Organization (WHO) and defines it as the functional provision for an adequate physical, social and mental development, which promote in its inhabitants the conditions of health, safety, hygiene, comfort and privacy, under the environmental, sustainable and resilient approach. It includes secure tenure and location, adequate structure, sufficient spaces, necessary basic services, safe household goods and consumer goods with an adequate environment. It is considered as the physical refuge where an individual resides, called a home and that establishes family or friendship relationships with a group of individuals who cohabit, and who are part of a community with their neighbors in a geographical space.

According to the last national census, the population in Mexico is 126'014,024 million inhabitants, but in what way, does housing provide the conditions of dignified habitability for as a habitable, sustainable and resilient architectural space, which promotes a sustainable education that contributes to mitigate climate change, as well as contribute to sustainable development?

Starting from the fact that housing is a systemic process between the interaction of the physical envelope and the activity, they form a process of adaptation and achieve the well-being of the inhabitant, generating flows of energy and matter in the biological, sociocultural, and economic fields. (Cervantes Borja & Maya Pérez, 2017, p. 92). And in a particular way in the field of life of the human being in the house, water is a vital resource that allows to maintain the health and hygiene of its inhabitants, from the drinking water that is defined as one that does not generate any significant health risk and is suitable for all domestic use, from hygiene to cleaning (WHO, 2006). This coverage in Mexico establishes for urban areas 96% and for rural areas 85%, however, 1.6 million people do not have drinking water in urban areas and 7.2 million in rural areas. (Breña Puyol & Breña Naranjo, 2020). In addition to the above, the average natural availability per inhabitant in a year is made up of rainfall, evaporation and population density.

According to the population growth in Mexico, there has been a 70% decrease in the availability of water resources accessible to the population from 1955 to 2020 as shown in Table 3.

Year	Inhabitants	M3/ Inhabitants	% Availability
1955	32 350 592	11500 m3	100%
2004	104 500 000	4094 m3	64%
2020	126 014 024	3500 m3	70%

Table 3. Historical availability of water resources.

Source. INEGI, CONAPO and Breña Puyol, A.F. & Breña Naranjo, J.A, 2020. Availability of water in the future of Mexico. science. Mexican Academy of Sciences, 58-3. ([https://www.amc.edu.mx/revistaciencia/images/revista/58\\_3/PDF/09-550.pdf](https://www.amc.edu.mx/revistaciencia/images/revista/58_3/PDF/09-550.pdf)).

Based on these variables in Mexico in 2020, 3500 cubic meters per inhabitant were counted (Ministry of the Environment, 2021), placing it in a country with low availability as shown in Table 4.

	m3/ inhabitant/año	Classification
<b>Average natural availability per inhabitant in a year</b>	Minor to 1000	Extreme scarcity
	Between 1000 y 1700	Critical shortage
	Between 1700 a 5000	Low
	Between 5,000 y 10,000	Medium
	More to 10,000	High

Table 4. Availability of water per inhabitant

Source. Breña Puyol A.F. & Breña Naranjo, J.A, 2020. Availability of water in the future of Mexico. science. Mexican Academy of Sciences, 58-3. ([https://www.amc.edu.mx/revistaciencia/images/revista/58\\_3/PDF/09-550.pdf](https://www.amc.edu.mx/revistaciencia/images/revista/58_3/PDF/09-550.pdf)).

As for the regional distribution of water, in Mexico it is divided into 13 zones, for this case, the basin of the Metropolitan Area of Mexico City is retaken, which is located as number XIII called Aguas del Valle de México and Sistema Cutzamala, which serves 121 municipalities and mayors. Currently, the National Water Commission (CONAGUA) reported that, from October 1, 2020 to May 23, 2021, it has decreased by 7.5% compared to previous years. (Secretary of the Environment, 2021) This has led to a decrease in the levels of the dams and the decrease in the endowment of this vital resource, as can be seen in figure 1, the relationship of the population density with renewable water / m3 / inhabitant / year is 144, which implies being the lowest of all areas of the country and with a population density of 1301 inhabitants per Km<sup>2</sup>.

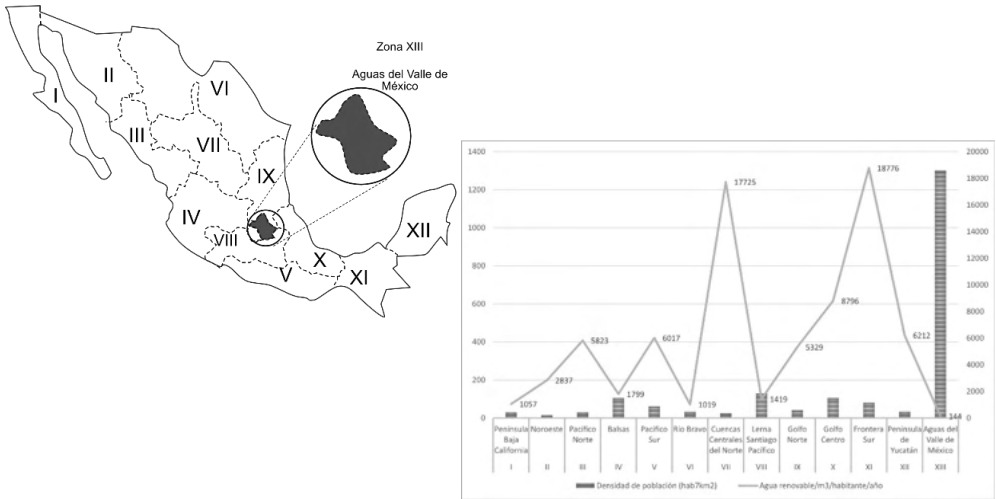


Fig. 1 Water distribution regions in Mexico.

Source CONAGUA 2021

When analyzing the importance of optimal water use, sanitation is analyzed, which is defined as the separation of wastewater, however, these are discarded to the drainage without being reused, registering that this wastewater in 2000 generated an expense of 252 m<sup>2</sup> / second. (Breña Puyol & Breña Naranjo, 2020). So, in the buildings continues to eliminate black water and gray water. The first are discarded from the toilets and the second from washing machines, sinks, and showers.

The WHO indicates that the recommended water consumption per person is 50 L per day, however, when analyzing the impact of water on housing, an inhabitant in Mexico uses 262 L per day, with a cost of \$ 1.20 Mexican pesos as of April 30, 2021, which represents an expense of \$ 315.00 pesos per day and if it is considered that the population of the metropolitan area of the CDMX is 21'804, 515 inhabitants (INEGI, 2020). This means a real consumption of 5,712 million liters per day of a scarce and finite resource.

Countries of the European Union such as Germany, work to reduce water consumption, as shown in figure 2, registering 125 L per day, with an average in Europe of 135.6 L, (European Environment Agency, 2018) together have bet on wastewater treatment, environmental legislation, but, even so, they also face challenges in this area, due to climate change and the increase in population, however it is worth recognizing the awareness towards its population for reducing water consumption with actions such as the International Decade for Action "Water source of life for the decade 2005-2015" of which the project "Eine Welt Netz NRW" stands out, which from educational materials seeks that students learn the global use of water with options for its protection as well as the Italian wastewater project "Acqua Spreco Zero" that through didactic panels, show students the best practices. (UN, 2015)

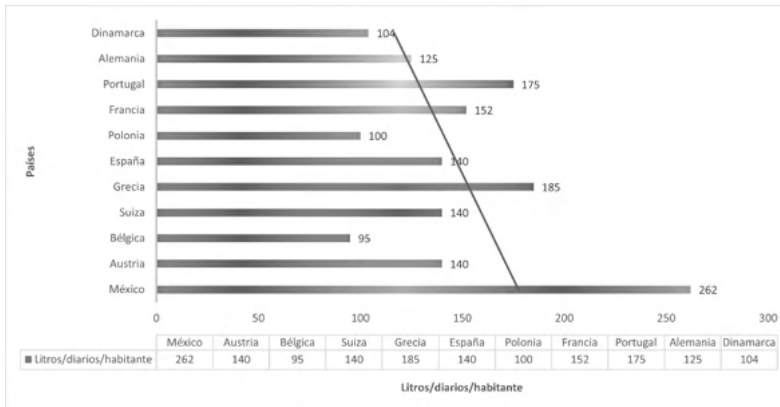


Fig. 2. Europe-Mexico water consumption. fountain. European Environment Agency, 2018. Water consumption in Europe: major quantitative and qualitative problems. <https://www.eea.europa.eu/es/senales/senales-2018-el-agua-es-vida/articulos/consumo-de-agua-en-europa>.

It is important to mention that environmental education, is a significant antecedent of citizenship education for sustainable development, has already proposed pedagogical strategies that seek to raise awareness about the responsibility of human beings with the planet, promoting the formation of critical and participatory actors, so it covers the environmental and social in contributing to short-term solutions, medium and long term, so these actions promote the adoption of sustainable lifestyles. (Sanchez, 1979)(Calixto Flores, 2012)(De la Pena & Vincens, 2020)

With the focus of the UNESCO proposal, it is now necessary to propose didactic alternatives to problematize human beings in recognizing the importance of the proposals of Education for Sustainable Development from the environmental, social and economic field, analyzing attitudes, values and beliefs of the family, its relationship with nature and technology as a response to its commitment to configure its housing as a sustainable unit.

This leads to raise the importance of raising awareness among users to carry out the treatment of rainwater for housing use (rain harvest) as well as the reuse of soapy gray water, derived from the washing machine from passive ecotechnics.

Ecotechnics arise with the need to provide solutions to make the use of natural resources more efficient and are defined as “devices, methods and processes that promote a harmonious relationship with the environment and seek to provide tangible social and economic benefits to their users, with reference to a specific socio-ecological context” (Ortiz-Moreno, et al., 2014, p. 16)

Ecotechnics are classified according to the physical and environmental elements they serve and can be from the atmosphere, water, land, and energies. These can be passive as systems that capture energy, store, distribute without the mediation of electromechanical elements, according to the materials and natural phenomena used (Mayorga Cervantes, 2017). As well as active ecotechnics in which the system that captures or distributes energy

from electromechanical elements.

Eco-technologies that focus on the recycling of water, from gray, sea, domestic, black, rainwater and drinking water.

Therefore, the process to incorporate ecotechnics is necessary to establish in the educational approach from the environmental problem to be solved from the causes and consequences, the management capacity of the users to modify these problems to influence their environment, as well as the strategies and didactic resources to motivate these changes.

## METHODS AND MATERIALS

Within the framework of this research, in a particular way, it was sought to address how it is possible to promote sustainable education by non-formal means in relation to the closest context of individuals that is the relationship of their housing and their actions that account for their environmental education, with the recycling of water and its commitment to generate these changes

Based on an action research methodology, it seeks to promote the participation of housing users, considering the participation of this community, self-evaluate housing from the environmental, social and economic sphere; So, the following research question arises: How do the inhabitants of Mexico City use natural resources in the field of their housing?

And the hypothesis is built that, by strengthening a sustainable education in the inhabitants of single-family homes in the CDMX, who implement and appropriate ecotechniques for the recycling of gray and rainwater, it will contribute to the efficiency of this resource, generate a sustainable culture that contributes to mitigate climate change.

With the independent variables of strengthening sustainable education and the dependent variables, implementing ecotechnics for the recycling of water and improving the efficiency of this resource in the environmental and economic field, as well as generating a sustainable culture, the objective is established to recognize from the approach of the users, the needs of the existing homes in the metropolitan area of Mexico City in terms of the use of water in their home, its contribution to sustainable development and climate change mitigation. Therefore, a quantitative cross-sectional observational exploratory diagnosis was made to a random sample of 113 people from ten mayor's offices who attend the baccalaureate at the Center for Scientific and Technological Studies No.2 Miguel Bernard in the CDMX, with a closed questionnaire of 20 items, made up of demographic data, water consumption, energy, waste, comfort, resilience and work at home <https://forms.gle/Laq56VXBPavKg5Ux7>

This scope addressed some basic elements regarding the use of natural resources, fuels and wastes. In this work, the results are analyzed in relation to their perception regarding the use of water and its recycling as well as its commitment to contribute to the



mitigation of climate change as part of a sustainable society.

## RESULTS

According to the study, it is detected that families are integrated in 73.5% of 4 to 6 members, with 63.2% living in an independent house and 23.1% in apartments.

The sample that attends the CECyT 2 Miguel Bernard, are distributed in 12 municipalities of the CDMX, 16 municipalities of the State of Mexico and in 1 municipality of the State of Hidalgo in the Mexican Republic, as shown in figure 3.

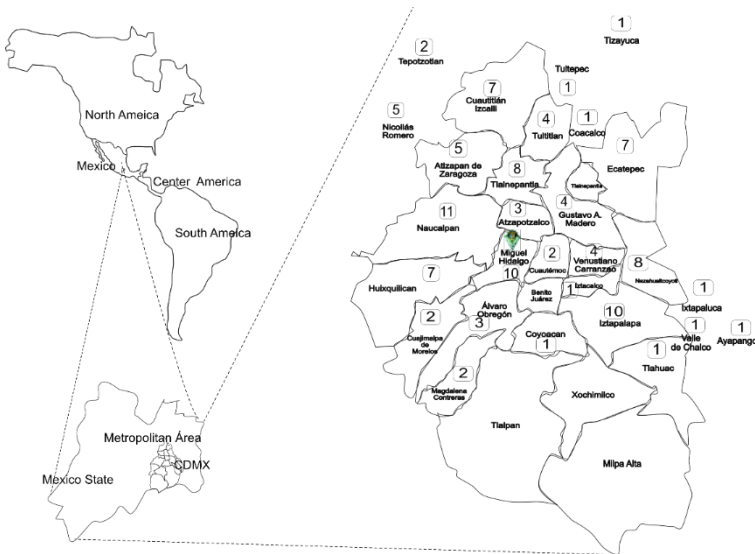


Fig.3 Location of Mayoralties and Municipalities in metropolitan area CDMX. Own elaboration.

The frequency of subjects in each of the municipalities varies from 1 to 11, considering that very distant municipalities such as Iztapalapa, 10 people come from the sample and even one moves from the municipality of Tizayuca in the State of Hidalgo as shown in figure 4.

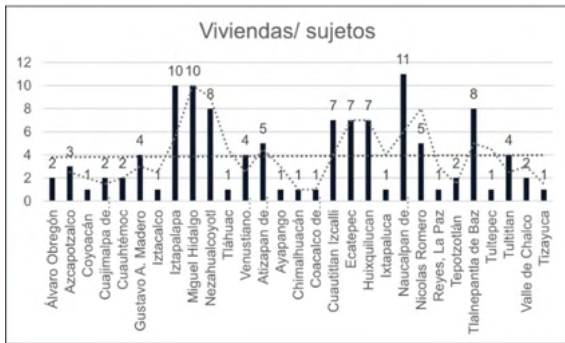


Fig. 4 Distribution of dwellings/inhabitants by mayor's office and municipality. fountain. Own elaboration.

In relation to the actions carried out in homes, it is established that 75% if they have drinking water, and although 91.5% establish that they do not carry out water collection actions, and only 8.5% indicate to carry them out, however they consist of placing tambos or buckets in rainy seasons. As for the recycling of gray water, mainly derived from washing machines, 82.5% indicate not to carry them out and 17.5% that yes, for immediate use in cleaning toilets and bathrooms.

Despite the fact that the metropolitan area of Mexico City has an average solar radiation of 5.3 Kw/h/m2 on an annual average according to the measurement data of the Tacubaya Station in Mexico city, only 7.7% use solar water heaters compared to 70.1, which it uses as a tank. (Smartbitt, 2017)

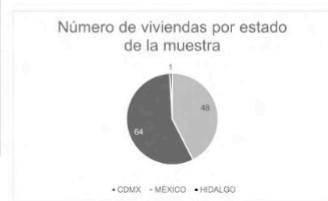
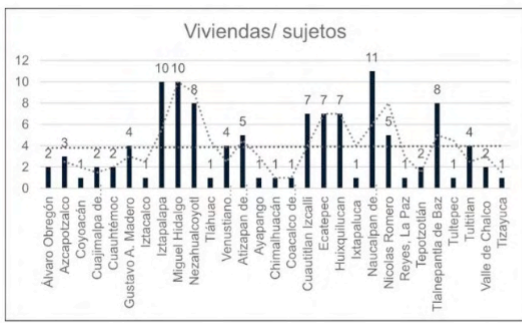


Fig. 5 Distribution of dwellings/inhabitants by mayor's office and municipality. fountain. Own elaboration.

In relation to learning actions and strategies within the framework of environmental

and sustainable education that allow them to implement technology in their homes from passive eco-techniques that promote transforming their homes and modifying their habits under this approach, as can be seen in Table 5, which 70.9% are interested in making changes in actions and habits in their home, to contribute to a sustainable society and the mitigation of climate change and 76.1% interested in learning how you can implement actions and devices that improve your home in terms of the use of natural resources and the comfort of its inhabitants.

Therefore, it is proposed to promote environmental and sustainable education of a non-formal type based on metacognitive strategies to recognize their assets and skills and integrate with the participation of users, ecotechnics such as micro changes of water recycling to transform their housing into sustainable units, which improve the quality of life in existing homes, fostering synergy towards communities and regions.

Learning and change actions based on educational strategies	Yes	Maybe	NO
I. Interested in making changes in actions and habits in your home, you would contribute to a sustainable society and the mitigation of climate change	70.9%	27.4%	
II. Interested in learning how you can implement actions and devices that improve your home in terms of the use of natural resources and the comfort of its inhabitants	76.1%		23.9%

Table 5. Result Educational strategies to implement ecotechnics of water collection and treatment in homes exploratory study (23/03/21). fountain. Own elaboration.

## CONCLUSIONS

The problem in the use of natural resources, particularly water, has been addressed for more than 20 years, from the focus on public policies to proposals for sustainable housing in the metropolitan area of the CDMX, however, although these contributions are very valuable, to date this culture of water care is not observed in the population, even if they have been equipped with eco-techniques and mechanisms, users are unaware of their operation and maintenance so they return to the old practices.

In sustainable housing, the habitable and the inhabitable interrelate and is affected by the repercussions of climate change on urban functioning, so it seeks to promote the participation of users in optimizing through passive ecotechnics, these spaces, according to their expectations and promote democratic construction processes such as self-production and self-consumption to ensure that housing, are configured as sustainable units.

Derived from the study, it is observed that existing homes, that more than 90% do not have the minimum infrastructure of passive ecotechnics to carry out the treatment of rainwater for housing use (rain harvest) as well as the reuse of soapy gray water. And it is rescued according to the study that there is the interest of young people to contribute and make this type of technological devices in their homes.

This work represents a starting point to design transdisciplinary metacognitive strategies of non-formal education for the whole community, from generating micro changes of existing housing, promoting the participation of its users from the particular, in order to generate a synergy towards the communities and regions, mediated from monitored web applications by professionals dedicated to habitat transformation, which allows the user to recognize their assets and skills and are configured as actors in the transformation of their home as a sustainable unit that impacts their community and region.

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A black and white photograph of a hand gently touching a mound of dark, rich soil. The hand is on the left side of the frame, with fingers slightly spread. The soil is on the right, showing its texture and depth. The background is a blurred continuation of the soil.


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A close-up photograph of a human hand with light skin and manicured nails, gently touching a vibrant green, textured surface of moss. The background is a dense, out-of-focus forest floor covered in similar moss, creating a rich, natural atmosphere.

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