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ENVIRONMENTAL IMPACT, REDUCTION OF GARBAGE GENERATION FROM PET PRODUCTS IN UNIVERSITIES OF THE COUNTRY

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Abstract: The main objective of the study is to propose alliances between the university and the productive sector by reducing the generation of garbage in pet products, modifying the attitude of carelessness that is being generated in this regard about the importance of creating conditions that make possible well-being for current and future people. generations. Ethical knowledge is not spontaneous; it requires working on it through education; the country's institutions must set the important standard for caring for the environment and in all strata that promote ethics for sustainability in generating less garbage, achieving a degree of awareness and control. of their ways of life, taking responsibility for nature, exploratory and descriptive research was carried out supported by a mixed research scheme, qualitative with analysis of documents and quantitative with field work, an instrument was applied to 90 students and teachers with a level of 95% confidence and a 5% margin of error, descriptive analysis and verification of the hypothesis, interviews, observation, contributing to measuring the impact of the proposal on sustainable development in the marketing of the product in care of the environment.
Keywords: Alliances, Impact, Sustainability.

INTRODUCTION

PET (Polyethylene Terephthalate) is one of the most common and problematic plastics in terms of environmental pollution. It is important to be informed about the impacts of PET and ways to reduce its use to protect our planet. Every day we go to the cafeteria, buy a soft drink or water, when we finish drinking we throw away the bottle and that's it! A disposable container does not cause a big problem, millions every year? In a faculty of 1,368 students, 97 teachers, administrators and manuals consume 16.68 kilos of soft drinks, water and juice per day, generating more than 4.40 tons per year, for society it is truly an uncontrollable plague because our consumption and generation of garbage continues to grow. Despite the campaigns and only 20% is recycled at the national level, we see the rest in the streets, land, garbage, rivers, in any case it pollutes, the main consumption of PET in our country is that of soft drink bottles (more than 50 percent of what is produced) and 17% in water consumption.

García, Luna and Ceballos in 2021 made it clear that in the 2030 Agenda of the United Nations Organization (2015), in which, through 17 objectives with different aspects of urgent action on climate change, objective 12 production and Responsible consumption has gained strength over the years, they seek to understand and value the limits towards nature before the impact is negative, these limits must be reflected in consumption and production.

Responsible consumption must be worked on through education, putting into practice a method of awareness in what is acquired for the benefit of the environment and mainly in the economy. Add alliances with responsible companies, innovating in production that do not harm the environment.

According to INEGI data, in 2022, 2,000 million tons of PET were produced per year in the world and the rest are imported and only 6% was recycled. Data from ANIPAC (National Association of Plastic Industries.)

In 2022, Venkata, Debajyoti, Kutralam, Pérez &Martínez carried out research that provides details on how many microplastics are inhaled in Mexico City, researchers from the UNAM Geology group and IPN in collaboration with the Secretary of the Environment. (SEDEMA), the study was carried out in different dry and rainy seasons. More microplastics were observed in atmospheric dusts near industrial, commercial

and urban centers. We find ourselves inhaling almost 1,000 pieces of micro plastics a year and in the world. Through the consumption of fish and shellfish we ingest perhaps 10,000 pieces, they are so small that they can breathe and reach the lungs.

Plastic was invented in the second half of the 19th century and its commercial use only after the fifties of the 20th century. Due to its degradation alone, we currently have 30 billion plastic bottles. Today, no one is safe from microplastics. A little more than 360 million metric tons of plastic are being produced in the world; it is estimated that by 2050 this figure will triple if it is not stopped.

Magnitude of the problem. Plastic pollution went from 2 million tons in 1950 to 348 million tons in 2017, the United Nations (UN) made clear. The impacts of pollution due to plastics are a catastrophe in the context of the planetary crisis of climate change, more than 800 marine and coastal species are affected by this pollution, every year 11 million tons of plastic waste reach the oceans. plastic, this amount could triple by the year 2040, plastic will end up suffocating us all if we do not act quickly.

GENERAL OBJECTIVE

Generate a decrease in consumption of products packaged in PET.

SPECIFIC OBJECTIVES

Determine the generation of garbage in educational institutions based on PET

Identify the educational resilience method to reduce the generation of garbage from PET products.

Demonstrate the Environmental Impact in responsible educational institutions

RATIONALE AND APPROACH

Various literatures affirm the problem of PET garbage generation continues despite recycling and it is estimated that it will triple day by day if we do not stop the pollution of streets, avenues, rivers and seas. Responsible consumption must be implemented through education. Let's save our world urgently.

THEORETICAL FRAMEWORK

In 2021, Gavilanes & Tipán made it clear that "human values in students are generated from home, so it is important that educational institutions become the main transmitters, not only of information, of putting into practice habits that They contribute every day to good environmental education in students, reducing the accumulation of products in PET packaging, it does not matter if the institution is public or private, they all have a commitment to true change with environmental education, working creatively on motivation, responsibility and commitment to an ecologically sustainable, resilient environment, carrying out an active, inclusive and innovative education, transcending in an evolutionary way from education to teachers, students and society. The authorities must encourage the motivation of their teachers on the subject, for their training in the development of proposed projects, for the evaluation of results and continuous improvement.

Based on the results presented, it is necessary to establish guidelines including innovative strategies, which do not represent an extra investment that seeks to make society more resilient and achieve the proposed objectives. Creating true environmental education in students. a fundamental role in socio-ecological resilience in the face of climate change, which already places them as conscious beings that they are the main actors of true environmental change. (Pages 286-298.)

According to Sierra & Sevilla (2021) "the university professor uses his high resilience to reduce risk factors, today it is more complex to be a teaching staff if science and information technologies are taken into account, it is of utmost importance to know how the high resilience of that teacher who has managed to remain in the work of education for many years, making changes again and again to incorporate the technological innovations requested by the institution, the risk factors: not making changes to the way of teaching, periods of stress due to excessive activities, internal protective factors, skills to be a teacher (organization, flexibility and communication), sharing experiences, interaction with students, taste for their profession, complying with institutional educational changes.

In fact, "the teacher constitutes an important piece in the successful implementation of any educational change, so they see the changes as an opportunity for improvement, the educational panorama, especially that of higher education, has been characterized by phenomena such as technology, resilience and environmental education. (Sierra, Seville, Martin, 2019). Page 1-20

Pérez, M., Mateo, N., García, R., Mar, C. & Cruz, L. in 2015 made it clear that Mexico is the third world consumer of PET, after the United States and China, such as bottles for beverages and food packaging, in Mexico each person uses 225 bottles a year, so around 800,000 tons of PET are consumed per year. In Veracruz, a comprehensive management and prevention program has been created, 4,451 tons are collected daily, which represents 5.5% of the national collection, the state of Mexico 33%, Jalisco 7% and Nuevo León 5%

The main use of PET in our country is soft drinks followed by bottled water as part of our consumption habits, so it is of utmost importance to raise awareness among students. Van Breda & Theron in 2018 in research on resilience demonstrate that they overcome difficulties and become competent, resilient and successful individuals to face adversity. Schools must train teachers and students to enable resilience.

Kumar et al. In 2021 they made it clear that plastic pollution is still present in terrestrial and aquatic ecosystems, producing pollution and accumulation in the natural environment due to indiscriminate use and the percentage of recycling, generating a challenging problem for researchers, legislators, citizens and others. Stakeholders, plastic ban policies and public awareness are the main interventions, innovations are certainly needed to reduce and promote education for citizens to act collectively to minimize pollution.

Inger Andersen (UNEP), director from 2015 to 2019, makes clear in Breaking the Plastic Wave by Pew Charitable Trusts (2020) the fundamental basis of the path forward, the need for system-wide change and urgent action in the chain of value and demonstrate that we can reduce the amount of plastics aimed at zero plastic pollution in the world. Ramon Laguarta, president and CEO of PepsiCo, in this article mentions the challenge of plastic waste requires rapid collective actions and transformation in which society considers single-use plastic.

Society's growing desire for plastic products has seen plastic become ubiquitous in the marine environment, where it persists for decades, as global plastic production continues to increase, impacting natural beauty and biodiversity. (Lavers & Bond, 2017).

Chiba to et., in 2018 mentions the damage caused by plastic waste in large animals due to ingestion and the toxic dangers released from fragmented plastic on the function of commercially important marine organisms, through the food web with potential effects on human health, The United Nations sustainable

development goal mentions taking measures to reduce marine pollution.

It details the physical impacts of ingesting, inhaling or touching plastics, as well as the toxic chemicals associated with plastics due to the exposure of risks to workers, consumers, frontline communities and very remote communities, making it essential that there is an urgent need. to adopt an approach of caution and change. (Azoulay et. 2019)

Gámez in the 2023 newspaper El Tiempo made it clear that a great alternative to improve PET pollution in the town of Monclova, Coahuila, are plastic collection companies, currently the price per kilo is 5 pesos in the town, Juan Ramírez worker of a recyclable company, I assure that plastic production is currently very low, on a day with good movement we receive 200 kilos of bottles and other plastic objects and when the days are low we receive about 50 kilos.

In the case of Australia and New Zealand, Ragusa and Crampton in 2016 made it clear that in the application of surveys on the perceptions of drinking water in general and bottled water specifically, they revealed that 77% of those surveyed thought about the quality of their water. drinking water, 23% believe that tap water is better and 63% consider that it is a waste of money, the younger generations are the ones that consume the most bottled water.

In Japan, it is highlighted that policies focus on the study of factors that affect the environment and the reduction of disposable packaging is promoted while suggesting that residents prefer products that incorporate the least material. Zhang & Wen, 2014)

(Muñetón, Valencia, Vanegas & Restrepo, 2019) mention that to complete the strategies from the point of view of the producing companies, they take responsibility for the complete life cycle of the product as suggested by Klaiman et al. (2016). The government must create awareness that the problem is everyone's responsibility, in this sense it is to bring together all the actors of the responsibility function, this includes responsible production, responsible consumption and the government to achieve changes. From the international perspective, there has been an increasing mobilization to consider sustainability as a global priority through the sustainable development goals for the year 2030.

METHODOLOGY

It is based on descriptive and explanatory inquiry, supported by a mixed, qualitative research scheme with documented foundations, observation and interviews of cafeterias and convenience stores within the university campus in the sale and collection of PET products, a quantitative work study. field with real variables, objectives and relevant statistical management, an instrument was applied to 90 students and teachers with a confidence level of 95% and margin of error of 10%, the reliability of the instrument was 0.82 Cronbach's alpha.

HYPOTHESIS

H1= Raising awareness among students and teachers and offering products in packaging other than PET, contributes to reducing the generation of garbage in the Institution.

Ho= Training teachers and students that allow resilience contributes to reducing the purchase of PET products.

SAMPLE'S SIZE CALCULATION

$$n=\frac{N\,Z^2 * p(1-p)}{(N-1)e^2 + Z^2\,p(1-p)}$$

N=1523

Z= 95%

P= 50%

e= 10%

Instrument reliability statistics

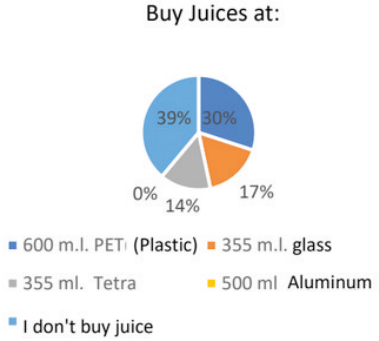
Cronbach's alpha	number of elements
.828	fifteen

RESULTS

FREQUENCY	
Soft drink purchases at:	PERCENTAGE
600 ml (Pet plastic)	40%
355ml (glass)	12%
355 ml (pet)	14%
500 ml (aluminum)	6%
I don't buy soda	28%

Graph 1: A total of 40% of respondents buy 600 ml soft drink. In PET packaging

FREQUENCY	
Buy Juices at:	PERCENTAGE
600 ml. PET(plastic)	30%
355 ml. Glass	17%
355 ml. Tetra	14%
500 ml Aluminum	0%
I don't buy juice	39%

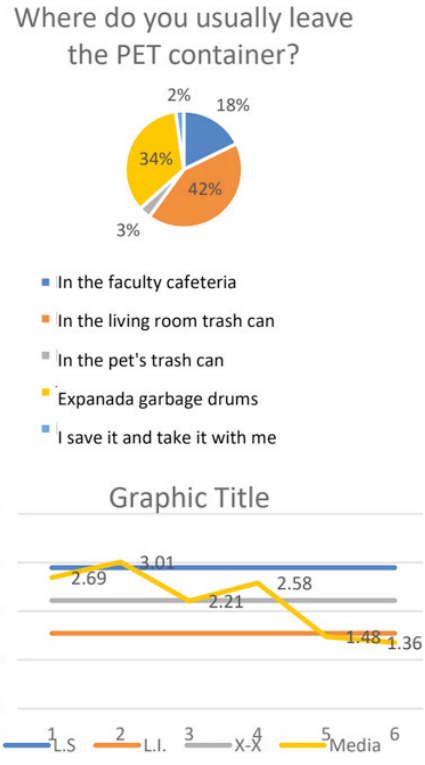


Graph 2: A total of 30% of respondents buy juice in PET containers and 39% do not consume juices.

FREQUENCY	
You buy water at:	PERCENTAGE
500 ml PET(plastic)	41%
500 ml Aluminum	0%
I don't buy water	59%

Graph 3: A total of 41% of those surveyed buy a bottle of water in a PET container.

FREQUENCY	
Where do you usually leave the PET base?	PERCENTAGE
In the Faculty cafeteria	18%
In the living room trash can	42%
In the PET trash can	3%
Garbage drums on the esplanade.	3. 4%
I save it and take it with me	2%



READING INTERPRETATION

The Variables Purchase of Soft Drinks in (1) and Purchase of Juices (2), They are above the Upper Limit of Normality, which indicates that they are representative variables of the phenomenon.

STUDY

The Variables You have your own thermos (5) and you would be willing to buy your soft drink in a container other than PET(6)

They are below the Lower Limit of Normality, which indicates that they are unrepresentative Variables (Irrelevant) for the Phenomenon of study so the students surveyed in an interview they mention the importance of only selling products in another type of packaging other than PET.

The rest of the variables (3 and 4) are within normality at ±1δ

	ECONOMY SAVINGS			
Soft drink PET container	Cost of convenience stores	Soft drink glass container	Cost of convenience stores	Saving
600ml	$19.5	500ml	$11.00	$8.5
JUICE	$18.00	500ml	$17.00	$1
WATER		WATER	IN THERMO	
500ml	$13.00	use	thermos	12
1 liter	$17.00			15

Table 1: Own elaboration. The savings are considerable, changing the purchase for another type of packaging other than PET. The monthly savings are significant in the case of soft drinks $255.00 pesos and in the case of water when using the thermos $360 in 500 ml and $450 pesos in a liter. Economize and contribute to the circle of people who are 100% responsible for the environment.

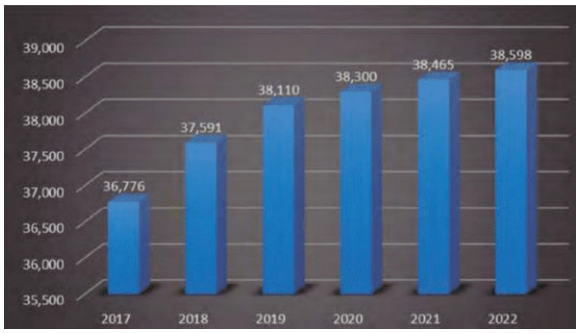
The World Environment Organization mentions that in 2022, 359 million tons of plastic waste will be generated worldwide.

According to data from the Institute of Statistics and Geography (INEGI). In 2021, 5.1 million tons of plastic waste were generated in Mexico and 1,040,084 tons in Coahuila

No.	Municipality	Amount of waste 2020 (t/year)	Estimated population by municipality (INEGI 2020)	Kg per person per day
17	Matamoros	10,745.2	118,337	0.2
18	Monclova	64,654.0	237,951	0.7
19	Morelos	2,783.0	7,928	1.0
20	Múzquiz	60,225.0	71,627	2.5
21	Nadadores	1,036.5	6,539	0.4
22	Nava	3,278.4	33,129	0.3
23	Ocampo	2,320.0	9,642	0.7
24	Parras de la Fuente	14,080.0	44,472	0.9
25	Piedras Negras	50,352.5	176,327	0.8
26	Progreso	4,728.0	3,239	4.0
27	Ramos Arizpe	29,074.0	122,243	0.7
28	Sabinas	25,550.0	64,811	1.1
29	Sacramento	361.0	2,471	0.4
30	Saltillo	253,604.0	879,958	0.8
31	San Buenaventura	5,315.5	24,759	0.6
32	San Juan de S.	20,075.0	42,260	1.3
33	San Pedro	34,075.0	101,041	0.9
34	Sierra Mojada	21,064.3	6,744	8.6
35	Torreón	203,774.2	720,848	0.8
36	Viesca	2,080.0	20,305	0.3
37	Villa Unión	426.0	6,188	0.2
38	Zaragoza	7,280.0	13,135	1.5
		1,040,084.0	3,146,771	0.91

No.	Municipality	Amount of waste 2020 (t/year)	Estimated population by municipality (INEGI 2020)	Kg per person per day
1	Abasolo	192.0	1,022	0.5
2	Acuña	59,128.3	163,058	1.0
3	Allende	9,125.0	23,056	1.1
4	Arteaga	6,124.7	29,578	0.6
5	Candela	384.5	1,643	0.6
6	Castaños	76,066	29,128	7.2
7	Cuatro Ciénegas	4,704.0	12,715	1.0
8	Escobedo	1,200.0	3,047	1.1
9	Fco. I. Madero	19,552.0	59,035	0.9
10	Frontera	33,086.0	82,409	1.1
11	General Cepeda	2,352.0	11,898	0.5
12	Guerrero	5,460.0	1,643	9.1
13	Hidalgo	5,080.0	1,735	8.0
14	Jiménez	240.00	9,502	0.1
15	Juárez	364.0	1,584	0.6
16	Lamadrid	144.0	1,764	0.2

Table 2: According to data from INEGI 2021, where Monclova, Saltillo, Piedras Negras, Acuña, Allende, Cuatro Ciénegas, San Pedro, Madero, Torreón, Saltillo, shows results of more than 50,000 tons per year in waste collection in 2021



Graph 1: Evolution of UAdeC enrollment. 2017-2022.

Planning direction source

A total of 38,598 students who make up the enrollment in 2022, 46% Saltillo Unit, 36% to the Torreón Unit and 18% to the North Unit.

Planning	Baccalaureate	Degree	Postgraduate	Total	%
Saltillo	5,793	10,933	1,207	17,933	**46%**
Torreón	2,589	10,580	621	13,790	**36%**
Norte	2,188	4,562	125	6,875	**18%**
UAdeC	**10,570**	**26,075**	**1,953**	**38,598**	**100%**

Table 1:Distribution of students by educational level and regional unit

Planning direction source

3,231 Teachers of which 2,119 are part-time and 1,112 are full-time teachers by 2022.

Calculation of Garbage Generation in the Faculty, with 1,368 Students and 72 Teachers. 25 administrative and manual

PET Soft Drink Bottle Weight 600 ml	
Material	PET
Neck size	24-410
Shape	Round
Volume	600ml
Weight	29g.
Weight PET water bottle 500 ml	
PET material	
Thread	28mm
Container height	20.3
Weight	18g.
Weight PET juice bottle 500 ml	
PET material	
Thread	28mm
Container height	137mm
Weight	21g.

PET WASTE GENERATION x DAY		
Product	Amount	**Kilos**
Refreshments	240	6.96 kg.
Water	400	7.20 kg.
Juices	120	2.52 kg.
Total	760	16.68 kg.

Table 4: Own elaboration.

Equivalent to :
400.32 kg. A month
4.40 Tons per Year.

Calculation of approximate tons in the Institution		
Population	**Students**	**Teachers**
	38,598	**3,231**

1,465 = 4.40
41,829= 125.62 Tons per year.

Generation of garbage by PET in public schools of Coahuila. in 2021. Data from INEGI

Primary Schools: 8,000 tons annually.
Secondary Schools: 6,000 tons annually.

Upper Secondary Schools: 7,500 tons annually.
Public Universities: 7,000 tons annually.
Private Schools and Universities

Schools: 6,000 tons annually
Universities: 3,000 tons

A total of 37,500 tons annually.

CONCLUSION

In the qualitative part regarding the documented literature, in 2021, Gavilanes & Tipán made it clear that "human values in students are generated from home, so it is important that educational institutions become the main transmitters, not only of information, of putting into practice habits that contribute every day to a good environmental education in students, reducing the accumulation of products in PET packaging.

Van Breda & Theron in 2018 in research on resilience demonstrate that they overcome difficulties and become competent, resilient and successful individuals to face adversity. Schools must train teachers and students to enable resilience. The main use of PET in our country is for soft drinks followed by bottled water as part of our consumption habits, so it is extremely important to raise awareness among students. with creativity, analysis, put into practice strategies that contribute to different aspects in urgent action against climate change, fulfilling objective 12 responsible production and consumption.

Therefore, the main hypothesis is accepted, using strategies that help raise awareness among students and teachers and offering products in packaging other than PET, contributes to reducing the generation of garbage in the Institution.

With respect to the quantitative part analyzed, 42% of students leave the PET container in the classroom trash can, 39% of students deposit it in the drum on the faculty esplanade and only 3 % deposit it in the containers intended for PET collection. Currently, regarding whether they would be willing to buy in a container that is not PET, only 23% of those surveyed responded affirmatively, so the rest of the respondents mentioned that they would have to see the quality of the products offered without thinking about the benefit of the environment, so we will continue working on creating a research project with a strategically designed plan to raise awareness and eliminate products in PET packaging in our faculty as a pilot plan and measure the reduction of waste generation in PET and create a 100% responsible institution contributing to the environment and within the project increase strategies focused on the municipality of Monclova that contribute to reducing the amount of waste found in the year 2021 according to INEGI data with 37,500 tons per year in public schools and universities and private in Coahuila. Regarding the economic savings that students would have in purchasing a daily soft drink of 600 ml per month, it is significant, in the case of water it is completely free.

Responsible consumption must be implemented through education, let's urgently save our world, if we really want to contribute to the damage to the environment.

We will start with the guideline from education, Implementing the method "contribute to the environmental impact, not to PET, use your thermos for the good of our country, which currently ranks sixth in PET consumer in the world. Just as we invite you to contribute in your institution with this project to reduce the generation of PET-based products, we will implement a Network in which we would like to implement this project as a contribution to our research and reach the largest number of institutions in our area. beautiful country.

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