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RESEARCH ARTICLE

TECHNOLOGY EDUCATION IN SUSTAINABLE DEVELOPMENT: A PERSPECTIVE FROM MIDDLE SCHOOL STUDENTS

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ABSTRACT

This article is the result of the first stage of a project named *Digital Learning* Project registered in the Postgraduate and Research Office in the Universidad Autónoma del Carmen. This project has a specific objective of promoting environmental education through technology, and it presents the diagnostic obtained by the application of surveys, to know what knowledge do middle school students have about the sustainable development. Focusing in the possible ways of improvement those zones where a high level of contamination exists. The population were students from two technical industrial middle schools with a public characteristic in different areas, the most relevant results are that 48% of the students surveyed mention that urbanization as the main reason of the problems of biodiversity and sustainable development in Carmen City, Campeche, Mexico.

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INTRODUCTION

There has been a lot of discussion about environmental education and how this could favor that people be more aware about how they contribute to the contamination on the streets, beaches, lagoons, rivers, deforestation, air contamination, among others. Nevertheless, it is important to be educated from a young age about this topic, since it is difficult to change adult behavior, due to a whole life time of acting that way. According to the Mexican Science Academy¹, the environmental pollution is a phenomenon that impacts a direct and indirect way to the health status of the society, also the transformation of the equilibrium of the ecosystems. In other words, human beings and wildlife animals are exposed to the contact of various contaminants with different levels of toxicity, which could be evident in the development of the production process, distribution or the utilization of resources for every day life. Furthermore it is added the increase and constant evolution of the population sectors and consequently

an uncontrolled industrial development that originates a diversity of problems for the environment affecting negatively when it becomes a contamination. Consequently, Twenergy argues that the causes of environmental pollution are multiple, identifying each other from the presence in the environment of any physical, chemical or biological agent whose concentration causes alterations in the structure and functioning of ecosystems are considered as part of this type of pollution². Currently, worldwide environmental, economic and social problems affect the planet causing enormous damage to society. With the overexploitation of natural resources and the use of highly harmful products we are increasingly affecting our ecosystems. Hence, the importance to educate and promote the useful values for the care of the environment because of it depends on the current and future life of our world. The Mexican Environment and Natural Resources Secretary³ proposes that the production or use of all goods has consequences over the environment while facing the loss or alteration of ecosystems and its biodiversity; levels of water, air and soil pollution; the transformation of the climate

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¹Gutiérrez, Herrera, (S/F). La ingeniería ambiental en México, Problemática ambiental en México

²Twenergy es un blog desarrollado y mantenido por Endesa como una iniciativa que busca contribuir en la eficiencia y la sostenibilidad su dirección es <https://twenergy.com>

³ Secretaría de medio ambiente y recursos naturales (2015) El cuidado del medio ambiente recuperado de <http://www.semarnat.gob.mx/educacion-ambiental/acciones-para-cuidar-el-medio-ambiente>.

changes globally and the reduction of the thickness of the ozone layer that protects from the dangerous ultraviolet rays are closely related and they represent directly the priority environmental in the short, medium and long terms. Subsequently, with this panorama the expectation of a broad and very ambitious environmental education, since it is purpose to contribute in a relevant way to the treatment of pollution problems, promoting responsible and ethical behaviors that allow a balance between nature and the perspective of technological development through research for innovation. As a strategy to achieve it, the Education System identifies a branch under the educative area, as an essential element in and for the formation of human resources in environmental terms as generic competence of individuals and manifestation of culture and civility to the nations. It is therefore an urgent national need, to validate the specific real scenarios about the knowledge or not of this international topic in all levels of education.

On the other hand, adults are often unaware about that topic and they will be in charge to educate the younger ones in this regard. Despite being in a technology- mediated society and having easier access to the information, there are still people who do not know about certain themes, in this case, sustainable development is what this paper aims and the subjects whom participate are adolescents from middle school. What do they know about sustainable development? How do they contribute to reduce and increase the sustainable development benefits?

Most of the teenagers between 11 and 15 years old have access to technology and internet, this means they could know about the main topic of this article and they could have raised awareness about what we must and must not do to reach an environmental balance. Based on the previous approaches, it is necessary to educate and teach from home and within the family the importance to preserve the environment with practical proposals such as reducing, recycling and reusing the majority of consumer products. Taking into account those proposals to create habits; especially in children, whose learning process tends to be faster. With the needs of create, promote and consolidate a collective consciousness to preserve the ecology and with the intention of favoring the environment, through educational institutions. It emerges the importance of acquiring the basic content to concrete as the process as strategies focused to the environmental education. In our country, there is a huge institutional structure which could be addressed to rescue natural resources. For example Elementary schools as a starting point, to guide the direction between the environment and the society. Since this last one, the providing source to human being life. As it can be stated, all humankind has caused pollution, loss of biodiversity, and depletion of natural resources, among other acts, that together have created a worldwide damage. That is why immediate actions are suggested such as raising awareness to care the environment, showing the pollution consequences and proposing rigorous attention to the environment; looking for valuable modifications which will make changes in the society of ecosystems. The formative and cultural advertising guides new principles into the elementary education in our country. It is the beginning to increase awareness and to preserve the environment surrounding us because children are the ones to learn new values and this learning leads to take care about the environment. The majority of children learn them easily. Similarly, they are technologically involved nowadays because of that it is easier to share them environmental topics, due to the fact that Technology could be innovate and entertained for

the children as a tool to get the values. According to Vygotsky⁴ students improve faster while collaborating with their peers, teachers, and parents or among others, when they get involved in active, significant and interesting tasks; it is an active process, not passive. Learners face the challenge of producing knowledge which they have to be motivated and active during their learning process. The activities should guide them to solve real problems, to produce linear and non-linear learning; this means it can follow an order or not. The main instrument to collect data was a survey, it was administered to 179 students between 13 and 15 years old from four middle schools in Ciudad del Carmen, Campeche; Mexico. The results shows that how much learners know and what they do to improve pollution in their home and their community. 27% of the subjects mention that the main problem affecting the biodiversity and as a consequence the sustainable development in Ciudad del Carmen, Campeche is the illegal hunting; the 23% of respondents think that soil, water and air pollution as a secondary problem under the previous one.

MATERIALS AND METHODS

This was a descriptive, cross sectional, non- experimental and quantitative⁵ approach research design, since statistics were carried out and according to the students results, there was a significant difference from the ones who perceive about sustainable developments and the ones who recognize little or do not know about the topic. The participants were middle school learners from Ciudad del Carmen, Campeche, the sample was determined by a simple random form, there were 179 students: 50 subjects belong to ETI 26; 50 ones are from ETI 5; 50 learners from ETI 25, its address is Av. Juarez, Calle 56 s/n Col. Obrera; 29 participants from ETI 21 and its address is Calle 10 de Julio s/n Col. Limonar, C.P. 24180, their age was between 14 and 15 years old. The Middle School ETI 21 was chosen because is located in the most polluted area in Ciudad del Carmen named la *Manigua* area. The ETI 25 is also located within the broad polluted area on the island so the two schools could have two different opinions about environment awareness students have. The instrument was a survey of 50 items organized in 13 sections. To have access before applying the survey a consent letter was sent to the principals of each school explaining the purpose of the research to get the permission acting as part of the ethical guides. Once the researchers had the permission, classes were selected to answer the surveys, groups without teachers or activities were chosen randomly. Every student answered the survey, they were informed the reason for asking them their support and then they started it, they handed it in when they finished and it lasted about 7 minutes in average to complete the survey.

RESULTS AND CONCLUSIONS

The results are on a first approach about what learners, from the two different institutions, know about sustainable development in Ciudad del Carmen. According to the results, it highlights that they know about the mentioned topics in the surveys, except from the desertification issue, the 70% of participants do not know about it. However, the 99% of

⁴UNESCO (2004) Las tecnologías de la información y la comunicación en la formación docente.

⁵Baptista, Fernández y Sampieri. (2010).

subjects are familiar with the climate change topic and 93% are interested in the use and conservation of biodiversity themes. In a section of the survey there are several difficulties which teenagers face to preserve the conservation of biodiversity, which it ranks first with 47% of learners who do not perceive the problems related to the environment, while 9% of them identify the lack of opportunity within the school environment to study biodiversity, placed in the last position of four listed difficulties. Furthermore, some strengths that young people have to participate in the conservation and sustainable use of the biodiversity in Ciudad del Carmen were identified, the considered ones while elaborating the survey were: new ideas of contribution, strength and vigor in the action, willingness to generate changes in society and environment, ability to disseminate in social, labor, academic and family circles; ease in handling new technology.

From the five mentioned strengths, the most answered was the willingness to generate changes in society and environment which 55% of the students chose. As it can be seen, students show a concern to help the conservation of the environment, they present tendency to be a part of that change. Finally, a list of activities were proposed which could be interesting for the students to learn and promote the sustainable use of biodiversity conservation and the relief of the climate change, the most interesting topic with a 33% of popularity was the implementation of workshops to attend and participate, following with a 27% the volunteer one. Regarding to the question why biodiversity is important, its sustainable use, knowledge and conservation, students from the different middle schools answered: They give greater importance to the fact that it provides food, followed by economic resources provided, below that one it is the cultural value and the least importance for them it was the esthetic value. The 60% of the surveyed students mention that it is important to know and to be interested in topics referring to help their community looking for a sustainable development. Besides, the results show they are willing to participate in several activities to improve their locality. For that reason, 58% of the students think that reforestation and ecosystem is a solution to preserve the biodiversity, 31% of the subjects believe that the implementation of government programs are part of solutions too, and 11% of the students consider that a solution is through environmental education.

51% of the learners perceive that the actions which could avoid the loss of biodiversity, reduce the desertification and mitigate the effects of the climate change on the island is the restauration of the mangrove forests, conservation of beaches and other ecosystems. Although the Middle School ETI 21 is located in the *Manigua* area where there is a high degree of contamination, the students answered that there is a lack of opportunities to join programs focused on improving and preserving the environment in general, as well as the general unawareness of those problematic, teenagers face those difficulties. On the other hand, their identified strength and in other young people is the will to generate changes in both the society and environment. However, the students from the different school responded that the action aid is more in the restauration, this means, once a problem arises they prefer to correct it, by contrary, the environmental education is one of the options with less consideration to execute when this should be the first one; human beings must receive that kind of education since they are children, while growing up they could propose actions to contribute to their community and thus to the island of Ciudad del Carmen. Finally, the results from the surveys show that even students are aware about aspects related to sustainable development, it is not appreciated in the surroundings where the middle schools are located, mainly in the *Manigua* area, considered as one of the most polluted on the island.

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