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Comparative Study of Sustainable Competences Acquired By Students of Sociology and Medicine of the UAGro: Conservation of Mangroves

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Abstract

Environmental issues have forced universities in forming sustainable skills in students. This study was done from January-September 2019 and its purpose was to form sustainable skills in students of sociology and medicine of the Autonomous University of Guerrero (AUGro) on the conservation of mangroves. To promote those competencies was necessary design and apply a workshop-course related to take care of mangroves. The evaluation of learnings was analyzed and compared. This research had to phases, a) the design of the mangrove workshop-course, and b) the implementation and evaluation of it. It was a quantitative and descriptive research. They were to groups took the workshop course, the first one at the Faculty of Medicine and the second one at School of Sociology. To realize the skills acquired during the course development was implemented a diagnostic and summative evaluation. An

instrument to measure previous and final learnings was the multiple choice questionnaire with variables about the mangrove ecosystem (course topics). According to the first phase the result was the creation or elaboration of an educational workshop-course for the conservation of mangroves with pedagogical and didactic bases and the application and evaluation allowed to know students of sociology and medicine acquired learning and skills in EE and to protect and conserve mangroves.

Keywords: Environmental Competencies, environmental crisis, mangroves, workshop course.

INTRODUCTION

University curricula under the competency approach, as the name implies, incorporate this methodological, didactic and pedagogical aspect in the education provided, thus, teaching and learning are developed under that approach. The competences are organized in core of competitiveness that enable and generate the fields of knowledge, skill, skill and attitude / value, which allow the construction of learning and significant intervention in the socio-cultural and political economic context in which the individuals and contemporary communities [20]. According to UNESCO (2012), sustainability is a central paradigm for the United Nations Organization and raises the need to reflect on a future in which the quality of life prevails, through the balance of social conditions, Environmental and economic. Consequently, education in this sense is called to generate transformations in people to encourage them to create more sustainable societies, having a profound impact on public awareness [21]. The education offered in universities must be oriented towards the promotion of sustainability, so that students promote sustainable competencies.

Sustainable competition should translate into conservationist behaviors of the socio-physical environment. Sustainable competition is defined as the display of behavioral abilities in response to requirements for the conservation of nature and the care of other people. That is to say, an individual will show that he is competent for sustainability insofar as he deploys skills for the solution of ecological and social problems that adjust to the challenges, demands and problems that he or society raise [22]. In this sense, the promotion of sustainable competences allows people or students to be more critical, analytical and supportive about what happens in the environment and in their social environment. In the educational field, the promotion of sustainable competencies depends on the teachers, the curricula, the students, etc. With respect to the teacher, he must have said competences to be able to implement socio-environmental strategies

with his students; In relation to the curriculum, if an environmental dimension is lacking, sustainability is poor; in relation to students, they will promote sustainable competencies, if they are present in the educational project, however, the lack of linkage of subjects with the environmental dimension, contribute in that sustainable competencies are not promoted.

In order for environmental competencies to be promoted, environmental matters must be included in the educational project and all that implies. The incorporation of Environmental Education (EE) into the school as a tool with which to form an environmentally educated society depends, to a large extent, on the role played by teachers. Based on environmentalized curricula, it is understood that the future faculty would achieve, during their formative stage at the University, the basic environmental competencies that can ensure their optimal training in environmental issues with which to introduce and promote EE at school and thus educate their students environmentally [29]. However, there are university curricula that are not environmentalized and, therefore, professors who do not have such competencies, as well as students who do not form sustainable competencies in their training field.

Background and justification of the study

The environmental crisis forces university researchers to design and implement strategies as for example to implement environmental dimension into the curriculum through some courses based on non-formal education, due to some study plans have not integrated the environmental dimension. The reason is that students form sustainable competences. An investigation developed that focused on a methodology to identify the presence of the environmental axis in educational programs of Bachelor in the Autonomous University of Guerrero, where it concludes that, with respect to the UAGro, the Educational and Academic Model dates from 1999, even when contemplates environmental issues, these have not been mainstreamed in the undergraduate and postgraduate curricula. It is worth mentioning that the 2013 Educational Model also does not provide guidelines for mainstreaming [28]. The study plans as mentioned in this study have not integrated environmental dimension as transversal method and its necessary students develop sustainable competencies. The objective of this study was to form sustainable skills in students of sociology and medicine of the Autonomous University of Guerrero (AUGro) on the conservation of mangroves. To get this objective was design, applied and evaluated a course-workshop based on a non-formal education, a didactic-pedagogical, constructivist and methodology by competencies. The research was developed through a mixed methodology, with a focus of action research and descriptive.

About mangroves:

The conservation of our coastal ecosystems requires that students, visitors, and the inhabitants of the coastal area and interested public have more information about them. Today, given the scenarios of climate change and disasters that have affected coastal residents, this need becomes even more relevant. Raising public awareness will allow greater contact between citizens and nature [3]. Mangroves in Mexico are distributed inside coastal lagoons and delta systems of the coasts of the Gulf of Mexico and the Pacific Ocean, with some coastal lagoons that have ephemeral mouths that open during the rainy season or by fishermen's action [2]. Mexico is a country privileged by its biodiversity, it occupies the first places in all the lists of biological diversity that have been prepared in the world according to CONABIO (2008). Biodiversity therefore encompasses three levels of expression of biological variability: ecosystems, species and genes. Mangroves, regionally known as "mangroves", correspond to the ecosystem consisting of trees or shrubs that grow in the coastal areas of tropical and subtropical regions [1]. Mangroves are called "mangrove forests", present in tropical and subtropical regions of the world. They are a group of highly evolved halophytes, which grow in the strip located on the border between marine waters and the mainland, generally entering the area between tidal estuaries, lagoons and coastal swamps. They are frequently flooded with seawater, during high tides Wolanski, Gang and Agatsiva [4]. Mexican mangroves are structurally heterogeneous ecosystems due to the wide range of environmental characteristics of the places where they develop, as a result of the combination of climatic, biophysical, geomorphological, hydrological and biological factors [5]. Gonzalez [6] from the mangrove the word mangrove is extracted, a mangrove is a biome that is also called salty forest or coastal wetland, is found in tropical and subtropical areas, swampy and waterlogged soil predominates. There is a diversity of mangroves currently depending on the type of tree that grows in them or the area in which they are located. For example, in the first case, there is the white, red, black and gray mangroves. We can see that everything depends on the tone of the mangrove, although in reality, there are about 70 tree species in this family. Also for the location of the mangrove we find a different typology. In this case they are riverside when they are on the banks of rivers or in parts where there is influence of the tides. They are edges when protected by bays or lagoons. Basins are considered if they are in stable soils with slow water renewal. And they are special when they are small and evolve in environments of high salinity and low nutrients, developing extreme temperatures. Lopez, Escurra, Agraz, Nettel *et al* [7] mangroves are a type of vegetation characteristic of the coastal areas of the tropics and subtropics around the world, in Mexico they are present on both coastlines (Atlantic and Pacific), covering at least 60% of the national coastline. There are six species in the country, four of them are common:

the red mangrove (Rhizophora mangle), the white mangrove (Laguncularia racemosa), the black mangrove (Avicennia germinans) and the buttonwood mangrove (Conocarpus erectus and Conocarpus erecutus var. Sericeus). Two of them (Avicennia bicolor and Rhizophora harrisonii) instead have a very restricted distribution, with the presence of only some isolated populations in the states of Chiapas and Oaxaca). FAO [7] this ecosystem is especially important, as it provides widely known environmental benefits, such as flood control, hurricane protection, source of nutrients for neighboring ecosystems such as coral reefs and capture of greenhouse gases, among many others. Over the last two decades the importance of conservation and protection of mangroves has increased substantially worldwide and nationally. SEMARNAT [8] Mexico ranks fourth in the world in terms of coastal wetlands after Indonesia, Brazil and Australia. Mangroves provide important environmental services: Protection and regulation of floods, recharge of aquifers, improvement of water quality by serving as a biological filter, prevention and reduction of coastal erosion, regulation of water quality and carbon sequestration. Rico, Gray, Benitez el al [9] in the mangrove forests of the Mexican coasts, there are five species of mangroves, of which Rhizophora mangle L. (red mangrove), Avicennia germinans L. (black mangrove o tight mangrove), Laguncularia racemosa (L.) Gaertn (white mangrove) and Conocarpus erectus L. (buttonwood mangrove). Lately Rhizophora harrisonnii Leechman in the State of Chiapas.

Mangrove socio-environmental problems

Mangrove forests are very complex ecosystems with multiple ecological functions and high economic value. They are also ecosystems that are subject to various negative impacts, which is causing their disappearance at an annual rate that ranges between 1 and 5% [10]. Greenpeace [9] in our country the mangrove area is disappearing at a rate of 2.5 percent annually, while, globally, the Food and Agriculture Organization of the United Nations (FAO) reports a loss rate of this ecosystem of 0.66 percent. "It is necessary to prevent further destruction of mangroves in exchange for economic compensation and prevent the construction of unsustainable tourist centers that only leave benefits in the short term and an unrestricted social group. We call on legislators and the federal government to protect this coastal ecosystem and the benefits it represents. Enough of illegal authorizations. " As with land-based agriculture, aquaculture and economic activities have caused environmental problems and social conflicts of great importance in coastal areas. Habitat modifications have been made in places where aquaculturists remove mangroves to establish pools for the breeding of economically important species (such as shrimp, shrimp and fish) and where cages or

pens are installed above seagrasses and coral reefs. Some environmental effects associated with this problem are the loss of fish and invertebrates that are discarded from the nets because they are unwanted, the introduction of exotic species, the spread of parasites and diseases, the inappropriate use of chemicals, the salinization of soil and water. and pollution of the coastal areas FAO, Primavera, Uribe, Urrego [11]. Arroyo, Camarero and Vasquez, Carsien point out that "man while remaining an element of the natural environment is becoming a factor on which the functioning of most ecosystems and even their conservation depends" so, the living and enjoying a natural environment makes the neighbor who sees it day by day in an ecological entity, and as such, must preserve this environment. Alvarez and Vega, referring to individuals, point out that they only develop environmentally consistent behaviors if they are trained "on environmental issues, are motivated towards it and, in addition, are able to generate qualitative changes, are convinced of the effectiveness of their action and that this will not generate significant difficulties" (p. 248), if it is assumed that the training referred to by the author is to acquire knowledge [12].

Sustainability and education

Sustainable development implies a new vision of the world, new ways of relating to nature, which involve transformations in different areas, such as scientific, technological, social, political, economic, cultural and educational. From the agreements of the Earth Summit of Rio de Janeiro (UNESCO, 1992), sustainable development, in the last 25 years has had a strong growth in the educational field. The perspective of sustainability entails the understanding of environmental behaviors, to generate educational proposals that influence the construction of an environmental citizenship, which prioritizes knowledge, knowledge, attitudes and sustainable values. Education is crucial to foster the ideals of sustainability. Education for sustainability [SE] is a learning process on how to make decisions that consider the long-term future of the economy, ecology, the equitable development of all communities, as well as the promotion of their Besong and Holland cultures [18]. Vega *et al.* The model for environmental training must be based on principles of sustainability and for this, it is necessary to understand the connections between economic, political and socio-environmental conflicts [19]. Education means a process of continuous socio-cultural development of the capacities that people in society must generate and that is carried out both inside and outside their environment, throughout their lives. Education implies promoting cognitive skills and structures, which allow sensory stimuli and world-reality perception to become meaningful information, knowledge of its construction and reconstruction, as well as values, customs, which determine our behaviors or ways

of acting, Alvarez [14]. The environmental crisis has reached such an alarming degree that it is now necessary, through education, to become aware of the importance of changing the forms of production and social welfare, as well as respect for cultural diversity and conditions that enable the existence of life on the planet. In this context, the importance of environmental education becomes evident, as one of the alternatives for the recognition of the conservation value of the planet's natural conditions [13]. At present, environmental education is spoken of as the most effective means to raise public awareness about the need to preserve the environment with a view to achieving a better quality of life in current generations and to come. The term "Environmental Education" was used for the first time in 1972, in Stockholm, during the International Conference on the Environment and since then it has been given the preponderance to generate the changes, through the acquisition of knowledge , attitudes and values, that allow to face seriously the environmental crisis of the world with a view to achieving a better quality of life for current and future generations, Vega and Alvarez; Gutierrez and Well; Zabala and Garcia; Ortega et al; Sosa et al., 2010; Sandoval [16]. The final years of the eighties and the first half of the nineties are years in which the E.E. It comes into relationship and is linked to sustainable development. In this sense, in the Rio meeting it is defined as «... lifelong learning process, based on respect for all forms of life ... such education affirms values and actions that contribute to human and social transformation and ecological preservation It stimulates the formation of socially just and ecologically balanced societies, which retain a relationship of interdependence and diversity among themselves" [15]. Environmental Education must teach how to continue development while protecting and conserving the life support systems of the planet. The culture for the conservation and rehabilitation of mangrove forests requires more attention. Education is an integral strengthening agent that promotes knowledge of the problems of the natural and social environment and links them solidly with their causes. Through education, residents can be taught to make rational use of the ecosystem. Environmental education is necessary to help raise awareness about the problem facing mangrove forests today [17].

MATERIALS AND METHODS

This research was done as an analysis unit for students of the Faculties of Sociology and Medicine of the Autonomous University of Guerrero, a workshop -course was developed with a time of 4 hours in each school. They were taken two groups, one in Sociology and another at Medicine. The sociology group was made up of students from different grades of the morning shift, among men and women, were 70 students. The group of medicine was integrated by freshmen, among men and women were 70. It was

implemented in two days, 13th and 14th, July 2019. It was a quantitative and descriptive study. During the development of workshop-course a multiple choice questionnaire was applied to know previous knowledge (diagnostic evaluation) or skills acquired after the course (summative evaluation). The questionnaire agreed to the thematic of the course and consisted of 10 questions about the mangrove ecosystem (Definition of mangroves, mangrove types, mangrove characteristics, ecosystem services, anthropic threats, institutions that report on the care of mangroves, federal protected areas, Ramsar-Guerrero, Ramsar site, FAO lost). For the students of sociology, 17 questionnaires were applied in the diagnostic evaluation and 20 in the summative evaluation. For the medical school, 30 questionnaires were applied in the diagnostic evaluation and 33 in the summative evaluation.

Techniques, procedure and instruments used:

The research was developed in two phases:

a) Phase a: Design of the course-workshop. The didactic sequence that established the planning on of educational strategies, didactic activities and learning evaluation of workshop course "Environmental Education for the Conservation of Mangroves".

b) Phase b: Application and evaluation of the workshop course "Environmental Education for the Conservation of Mangroves". During the workshop application, diagnostic and final evaluations were done, this allowed the facilitators to know the lessons learned and skills acquired.

RESULTS

Design of the workshop-course: One of the phases of the design of an Environmental Education for Sustainability project is contextualization, this is to characterize the network of the most significant relationships between: 1) The project environment where it is expected have a certain contribution and impact and 2) The basic elements of the educational project such as: objectives, contents, activities, materials, etc. [23]. Another phase of sustainability project is programming (the planning of specific activities), in this stage, the didactic sequence is elaborated. The design and elaboration of a didactic sequence implies adopting a didactic-pedagogical and methodological approach to plan the development of themes that correspond to the course or workshop to be taught, the strategies, forms of evaluation, etc.). Oxford Dictionaries [24] defines the word design as making a detailed plan for the execution of an action or an idea: designing a strategy; design a study program; It also defines the word design as a

creative activity that aims to project objects that are useful. When designing the design of any EE activity or program, the first thing we should do is plan. Planning is the rational and structured development of what is going to be done, determining what is to be achieved, what is intended to be transmitted, how it is going to be done, how to react in the event of any unforeseen event, what resources will be needed, and how the activity will be evaluated, Ruiz [25]. The elaboration of the didactic sequence of this course-workshop is also based on Tobon, Pimienta and Garcia [26] because they offer a general standard methodology for planning didactic sequences by competences from a socioformative approach. The format that used the didactic sequence of the course that was implemented in this research was adaptation of the didactic sequence format used by the Autonomous University of Guerrero in didactic level planning. The course-workshop mentioned in this research was based theoretically and methodologically on constructivism and skills education. The competencies build the best performance in the students to respond to the demands of the environment [27].

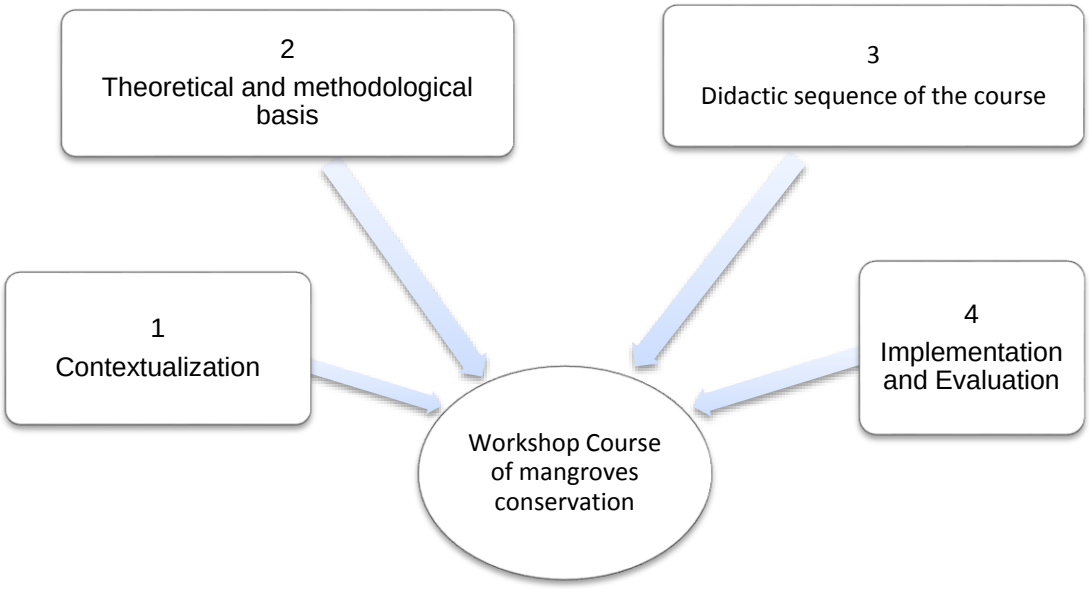


Figure 1. Design of Environmental Education workshop for the conservation of mangroves.

Application and evaluation of the workshop course: The design of workshop in the previous phase was fundamental because there was already a didactic organization and planning, as well as a methodological and pedagogical approach. There was only a session organized and planned contemplated this course, was developed on June 13th in

Sociology and on June 14th in Medicine.

There were about 70 students considering men and women in each school. As regards the facilitators, there was the participation of a PhD student in Environmental Sciences from the Autonomous University of Guerrero and two professors participating in this research work. The duration of the session was four hours (10:00 am to 2:00 pm), it was developed in a classroom of the schools selected in this study.

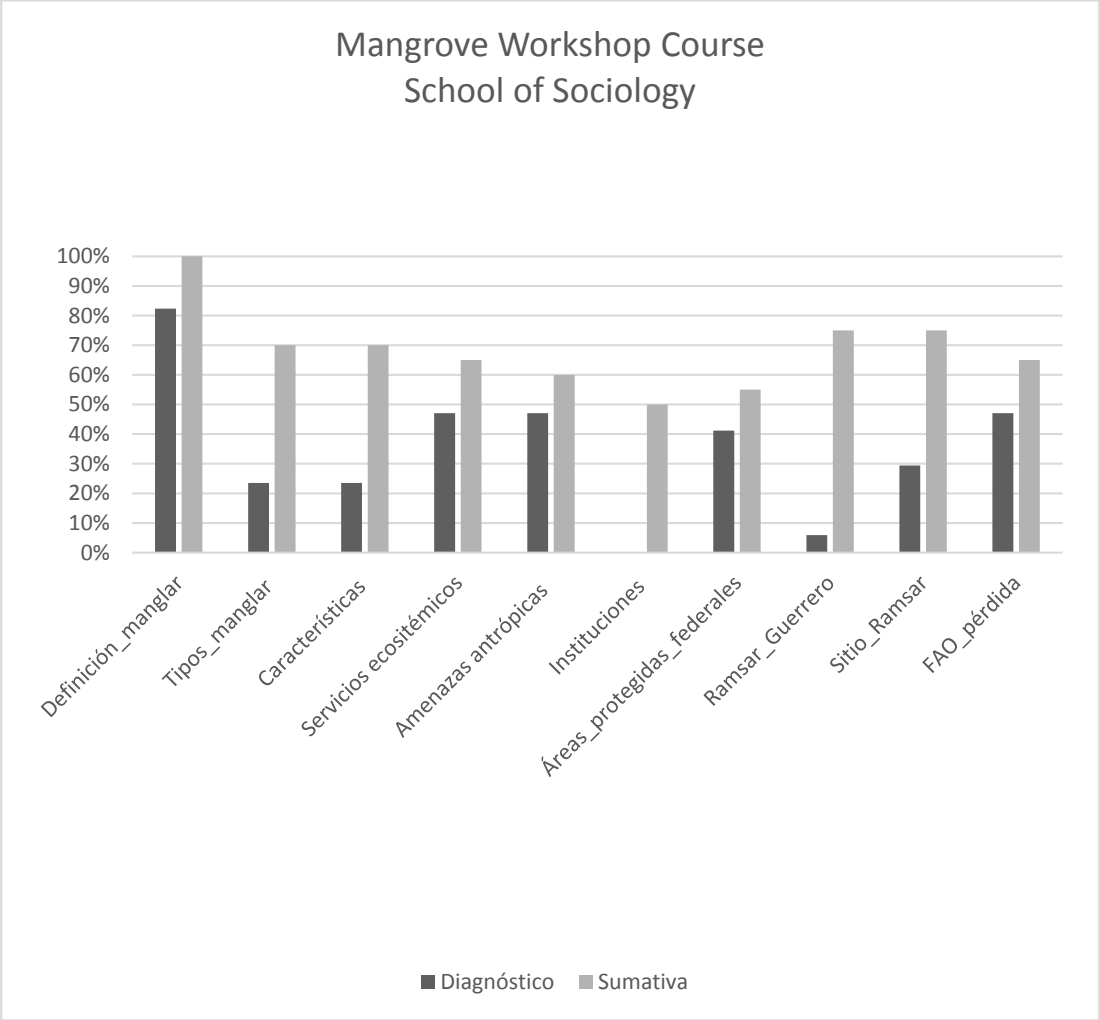
The session began by asking students previous knowledge about mangroves and the relation with Environmental Education. Some topics seen and activities made in the course were (Definition of mangroves, mangrove types, mangrove characteristics, ecosystem services, anthropic threats, institutions that report on the care of mangroves, federal protected areas, Ramsar-Guerrero, Ramsar site, FAO lost).

Evaluation of learning and acquired skills (Diagnostic and summative evaluation).

An instrument was used to evaluate the previous and knowledge acquired at the end of the course. This instrument consisted in a questionnaire with ten questions about the mangrove ecosystem, the questions in this instrument were related to the topic of the course (Definition of mangroves, mangrove types, mangrove characteristics, ecosystem services, anthropic threats, institutions that report on the care of mangroves, federal protected areas, Ramsar-Guerrero, Ramsar site, FAO lost). Although there were seventy students who took the course in each school only seventeen questionnaires were applied in the diagnostic evaluation and twenty in the summative evaluation in sociology school and at the medical school, thirty questionnaires were applied in the diagnostic evaluation and 33 in the summative evaluation.

According to the analysis of the results, the students of the faculties of sociology and medicine of the Autonomous University of Guerrero acquire greater knowledge about the mangrove ecosystem, its important function in our planet and the need to preserve and conserve it. Therefore, environmental education is a response to the environmental crisis caused, mainly by man. Students understand the complex functioning and degree of importance of mangroves, vital for a great diversity of species, including humans, as well as the situation of mangrove loss today worldwide and the need to create a collective environmental awareness.

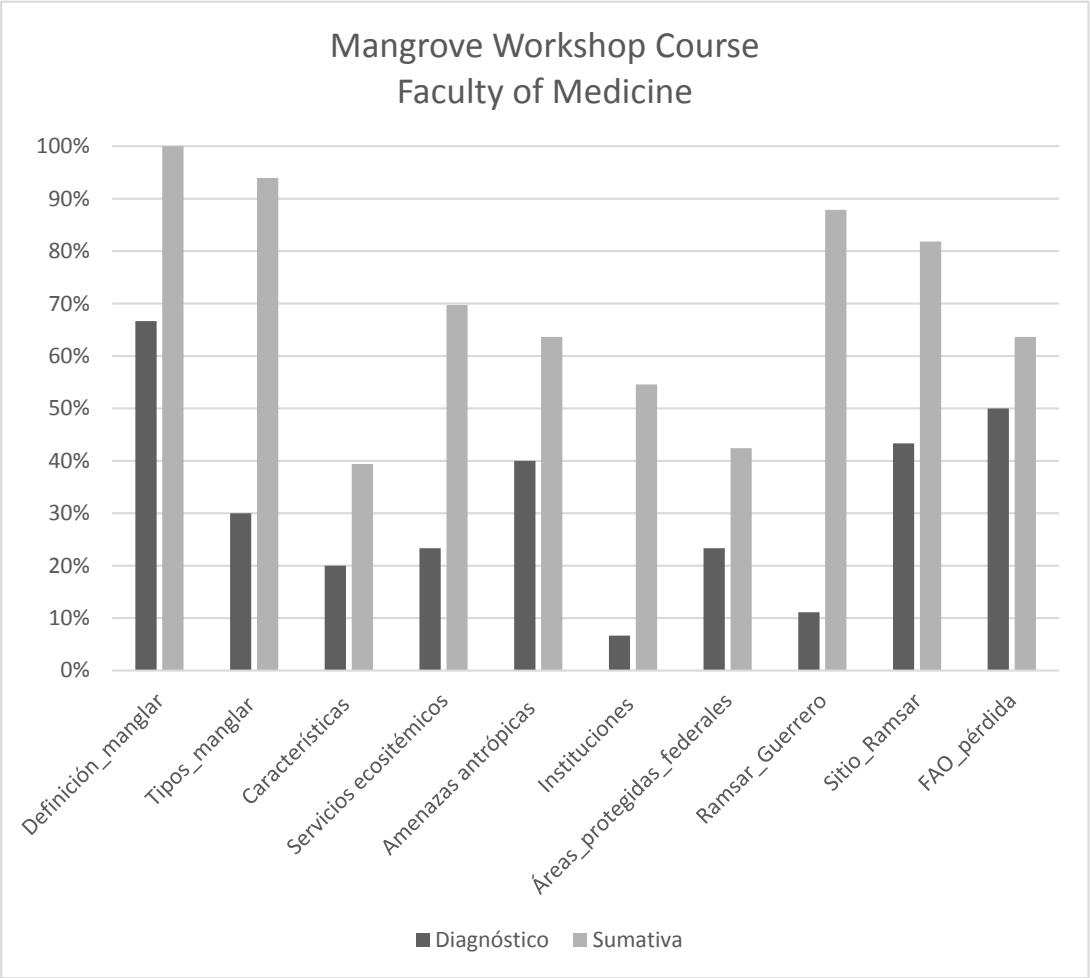
Table I. Evaluation of previous and final skills in the mangrove workshop course with sociology students.



X Axis= Definition of mangroves, mangrove types, mangrove characteristics, ecosystem services, anthropic threats, institutions that report on the care of mangroves, federal protected areas, Ramsar-Guerrero, Ramsar site, FAO lost (Previous and final evaluation).

Y=Axis= Percentage of knowledge acquired.

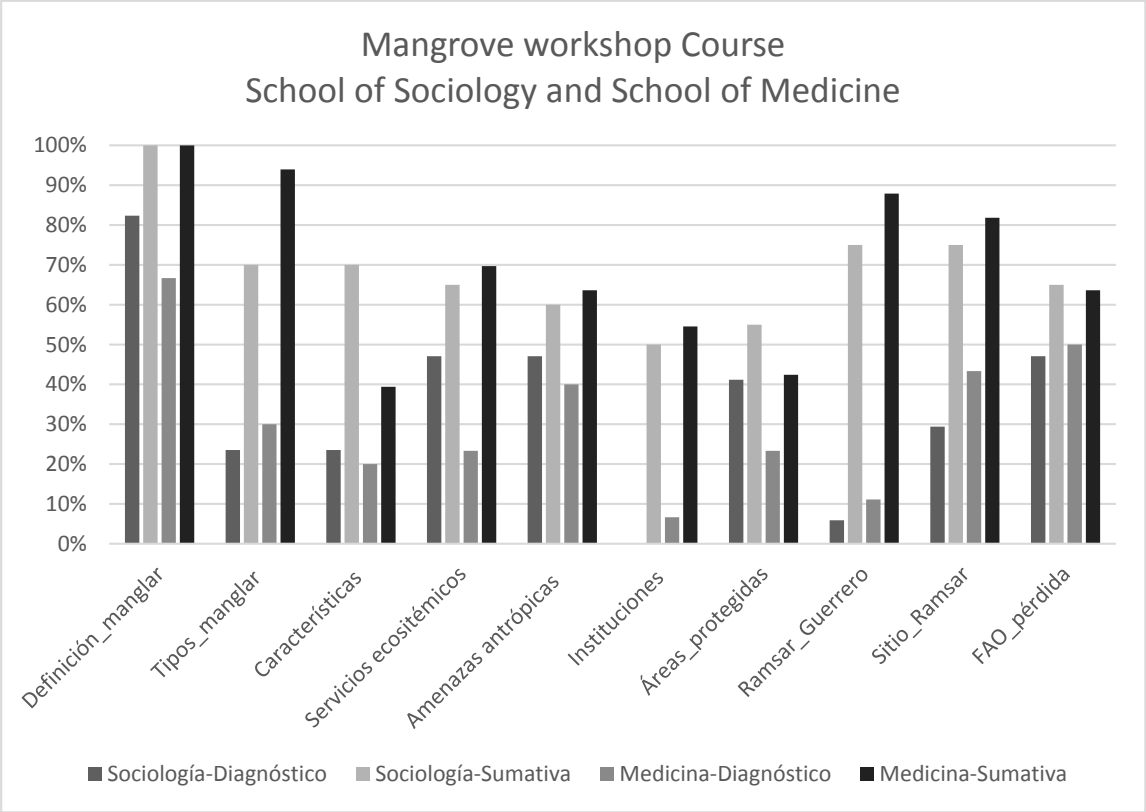
Table II. Evaluation of previous and final skills in the mangrove workshop course with medicine students.



X Axis= Definition of mangroves, mangrove types, mangrove characteristics, ecosystem services, anthropic threats, institutions that report on the care of mangroves, federal protected areas, Ramsar-Guerrero, Ramsar site, FAO lost (Previous and final evaluation).

Y=Axis= Percentage of knowledge acquired.

Table III. Comparison of previous and final evaluation of skills in the mangrove workshop course with sociology and medicine students.



X Axis= Definition of mangroves, mangrove types, mangrove characteristics, ecosystem services, anthropic threats, institutions that report on the care of mangroves, federal protected areas, Ramsar-Guerrero, Ramsar site, FAO lost (Previous and final evaluation at Sociology and Medicine Schools).

Y=Axis= Percentage of knowledge acquired.

DISCUSSION

The graphs show the results of the evaluations, diagnostic and summative, as well as the comparison between both faculties.

In question 1 regarding the definition of mangrove, before the course the students already had the notion of its meaning, however, in the summative evaluation, both faculties reach 100% of the students answer correctly, while in the faculty of Sociology there is an increase of 18% and in the medical school it is 33%. Knowledge of the environmental problem is fundamental, thinking about the global and making decisions locally, knowing to think and being able to act [30].

Question 2 that asks about the main types of mangroves found in Mexico, in sociology the diagnostic evaluation presents 24% of correct answers while in the summative evaluation they answer correctly 70% of the students, increasing in 46%; in this same question in the faculty of medicine in the diagnostic test correctly answer 30% and in the sum 94%, increasing the correct answers by 64%. The role of mangroves is essential for the life and development of biological species that inhabit these ecosystems [31]. Knowing the four types of mangroves that dominate the Mexican territory (m. Red, m. Black, m. White, m. Botoncillo) is essential for its conservation and avoid its use for firewood or wood for construction, although it is also important to arrive to agreements with traditional users and their awareness and awareness.

As for the third question corresponding to the characteristics of mangroves, 24% of the students of sociology, in the diagnostic analysis, answer correctly, while in the summative test they answer correctly 70%, presenting an increase of 46%. In the case of medicine, in the diagnostic test 20% of the students correctly answer, while in the sum they answer 39%, there is an increase of 19%. The great complexity that characterizes mangroves refers to an evolutionary and adaptive process [32]. It is important to know the great capacity of the adaptive mangrove ecosystem before hydrometereological events and its resilience.

Question four, which refers to the ecosystem services provided by mangroves, presents the following results, in sociology, 47% in the diagnosis and 65% in the sum respond correctly, with an increase of 18%. Ecosystem services provide natural resources for human well-being, including support, provisioning, regulation, and cultural services [33]. It is essential to achieve its conservation and understand the socioeconomic importance for the sustainability of coastal fishing communities, as well as for biological diversity

Question five, which indicates threats to mangroves, mainly of anthropic origin, presents in sociology, in the diagnostic evaluation, 47% and in the sum of 60%, reflecting a slight increase of 13%. While in medicine they respond in the diagnostic evaluation 40% and in the sum 64%, with an increase of 24%. It is necessary to reach an environmental awareness for the care and preservation of the mangrove ecosystem with local reality and problems.

Question six corresponding to government institutions that help the study and conservation of mangroves, in sociology in the diagnostic test do not present correct answers, that is to say 0%, but in the sum they answer correctly 50%, an increase of 50 is presented %. With respect to this same question in medicine, they answer only 7% correctly in the diagnosis and in the sum, 55%, presenting an increase of 48%. The responsibility is not entirely the state, government and society have the same

responsibility to achieve a sustainable management of natural resources.

As for question seven that mentions the states where mangroves are not found in federal protected areas, in sociology in the diagnosis they correctly answered 41% and in the sum 55%, an increase of 14%, while in medicine in the Diagnosis is presented 23% and in the sum of 42%, increased by 19%. Mangroves are vulnerable vegetations to various productive activities of human beings and it is important that the government implements public policies in conjunction with riparian communities to achieve common objectives and prevent the degradation of these ecosystems.

In the eighth question regarding the only Ramsar site in the state of Guerrero, in sociology in the diagnostic test only 6% answered correctly and in the sum 75%, it increases 69%; while the results in the medical school present in the diagnostic test only 11% and in the sum it reaches 88% of reagents, a 77% increase.

In the ninth question regarding the definition of the international agreement called Ramsar Convention in sociology, in the diagnostic evaluation 29% of the students correctly answer and in the sum 75%, an increase of 46%. In the faculty of medicine in the diagnostic test they answer correctly 43% and in the sum 82%, with increase of 39%. Few students knew that there is a Ramsar site in the state of Guerrero, where lute turtles are concentrated, considered to be critically endangered, as well as tortoiseshell and brown turtles, both endangered, and the presence of red mangroves, black, white and button. However, despite the great wealth of biodiversity it is an ecosystem that is threatened by the productive activities of the human being [34].

In the tenth question that refers to the loss of mangroves worldwide, in sociology in the diagnostic evaluation they present 47% and in the sum 65%, presenting an 18% increase. In the faculty of medicine in the diagnostic test, 50% respond correctly and in the sum 64%, with an increase of 14%. Understand that mangroves are important lungs of the planet, a habitat of great biological diversity and fundamental for various human socioeconomic activities will help to stop global losses with the participation of the actors involved to achieve their conservation.

CONCLUSIONS

The results show that the students of the faculty of sociology in the diagnostic evaluation present 35% of correct answers and in the summative evaluation it increases to 69%. While the students of the medical school in their evaluation diagnose they obtain 31% and in the sum they reach 70%. This means that environmental education is relevant to achieve knowledge of environmental issues and that the human being is very responsible for the degradation of the mangrove ecosystem. Education is the only

way to achieve environmental rationality, to have harmony and a true balance between human needs and use of natural resources. To reach the ideals of sustainable development, achieve environmental protection by changing attitudes and actions, from citizens, as well as the ruling class with environmental laws and policies that can reverse environmental deterioration, as well as research by the academy and lay the foundations and generate research to mitigate the damage done. Defending the land, water and air against any ruthless ambition that is governed solely by economic profits and profits, raise awareness with citizen participation and achieve community development that benefits the majority and not just a few so that there is a true understanding that It takes nature and that the human being is part of it and not owner.

Implementing a course-workshop that aims to educate for any subject in any area, as it was in this case about mangroves, it is because the facilitators or those who intend to implement a course, should know the methodology for its design and elaboration, likewise, to base on the pedagogical and didactic assumptions. Educating to conserve mangroves, it is of great importance, because the environmental crisis is present everywhere, mangroves like trees that grow in coastal areas in many parts of the world, allusion is made to Mexico and mainly to Coasts of the State of Guerrero must be protected because they are very significant in the environment and in the areas where they are born, for people and nearby communities. Universities must implement in its study plans the EE as a cross-cutting theme or any other method to link the environmental crisis with the disciplines oriented to educate about the biodiversity.

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Conflicts of Interest: The authors declare no conflict of interest.

REFERENCES

[1] Díaz, G., J.M., 2011, Una revisión sobre los manglares: características, problemáticas y su marco jurídico. Importancia de los manglares, daño de los efectos antropogénicos y su marco: caso sistema lagunar de Topolobampo. Rev. Ra Ximhai, 3, 355-369.

[2] López. y Ezcurra, E., 2002, Los manglares de México: una revisión. Rev. Madera y Bosques, especial, 27–51.

[3] Moreno, P. y Infante, D. M; 2016, Conociendo los manglares, las selvas inundables y los humedales herbáceos, 1st ed.; INECOL, OIMT, CONAFOR: México.

[4] Mera, C., 1999, Género, Manglar y Subsistencia, 1st ed.; Abya Yala: Ecuador.

[5] Rodríguez, M; Villeda, E; Vázquez, A; Bejarano, M; Cruz, M; Olguín, M; Villela; S. y Flores, R., 2018, Métodos para la caracterización de los manglares mexicanos, un enfoque espacial multiescala, 1st ed.; CONABIO: México.

[6] González, P., 2018, Manglar. ¿Qué es y qué tipos hay?; OK DIARIO CIENCIA: Barcelona, Cataluña, Available online: https://okdiario.com/ciencia/manglar-que-que-tipos-hay-2285444 (accessed on 6 oct 2019).

[7] Valderrama, L; Rodríguez, M; Troche, C; Velázquez, S; Villeda, E; Alcántara, J; Vázquez, V; Cruz, M. y Ressl; R., 2017, Manglares de México: actualización y exploración de los datos del sistema de monitoreo 1970/1980–2015. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, 1st ed.; CONABIO: México.

[8] SEMARNAT., 2016, Los manglares mexicanos; México, Available online: https://www.gob.mx/semarnat/articulos/manglares-mexicanos (accessed on 6 oct 2019).

[9] Aguirre, L. Plan para la conservación del manglar en la comunidad de el Carrizal Coyuca de Benítez, Guerrero. Mastery Thesis, Universidad Autónoma de Guerrero, Acapulco, Guerrero, 2018.

[9] GREENPEACE, México. Sin control la perdida de manglares en México; México, 2009. Available online: https://www.greenpeace.org/archive-mexico/es/Noticias/2009/Julio/manglar/ accessed on 11 oct 2019).

[10] Olguín, E; Hernández, M; y Sánchez, G., 2007, contaminación de manglares por hidrocarburos y estrategias de biorremediación, fitorremediación y restauración. rev. Int. Contaminación Ambiental, 3, 139–154.

[11] Uribe; J. y Urrego, L., 2009, Gestión ambiental de los ecosistemas de manglar. Aproximación al caso Colombiano. rev. Gestión y Ambiente, 2, 57-71.

[12] Yépez; G., 2018, La educación ambiental como freno a la degradación de la

naturaleza. el caso del manglar estuario río esmeraldas. Rev. Areté. 8, 87-102.

[13] Flores; C., 2015, Educación Ambiental para la sustentabilidad en la Educación Secundaria. Rev. Actualidades investigativas en Educación, 3, 1-21.

[14] Castillo; M., 2010, La importancia de la educación ambiental ante la problemática actual. Rev. Educare, 1, 97-111.

[15] González; M., 1996, Principales tendencias y modelos de la Educación Ambiental en el sistema escolar. Rev. Iberoamericana de Educación, 11, 13-74.

[16] Sereviche; C., Gomez, E; y Jaimez, J., 2016, La Educación Ambiental como base cultural y estrategia para el desarrollo sostenible, Rev. Telos, 2, 266-281.

[17] Linares; R; Tovilla; C. Y De la Preza; J., 2004, Educación ambiental: una alternativa para la conservación del manglar. Rev. Madera y Bosques, Es2, 105-114.

[18] Calixto, R., 2018, Una Experiencia En Educación Ambiental Con Estudiantes Universitarios. Journal of Sustainability Education, 18, 1-15.

[19] Molano; A. y Herrera, F., 2014, La formación ambiental en la educación superior: Una revisión necesaria. Rev. Luna Azul, 39, 186-206.

[20] Guzmán; M. F., 2012, El concepto de competencias. Iberoamericana de Educación, 60, 4, 1-13.

[21] Cuevas; J., 2016, Competencias para el desarrollo sustentable e incluyente, estrategias formativas e institucionales. Rev. COEPES, Desarrollo Incluyente y Sustentable 5, 17.

[22] Corral; V., 2012, La investigación acción. Sustentabilidad y Psicología Positiva. Una visión optimista de las conductas proambienatles y prosociales. Ed. Manual moderno. México, 23.

[23] Nieto, L., 2001, Modalidades de la educación ambiental: diversidad y desafíos. Ed. Rima. Brasil. 1-2.

[24] Oxford Dictionaries, Language matters. http://www.oxforddictionaries.com/es/definicion/espanol/diseno?q=dise%C3%B1o (Consultado: 08/06/2016).

[25] Ruiz V., C. S/F. Diseño de proyectos de Educación Ambiental. s/f, 3. http://www.juntadeandalucia.es/medioambiente/educacion_ambiental/disenoProyectos.pdf (Consultado: 08/06/2016).

[26] Tobón, S., Pimienta, H. y García, J., 2010, Secuencias Didácticas: Aprendizaje y Evaluación de Competencias. Ed. Pearson Educación. México. 132 p.

[27] Cuevas, L., Rocha; E. Casco., R. y Martínez, M. 2011, Punto de encuentro entre constructivismo y competencias. Revista Aapaunam, 1, 5-8.

[28] Aparicio, J; Rodríguez; C. y Beltrán, J., 2014. Metodología para la transversalidad del eje medio ambiente. Rev. Iberoamericana de Ciencias

Sociales y Humanidades. 9, 2014, 1-20.

[29] Álvarez, O; Sureda; N. and Comas; R., 2018, Evaluación de las competencias ambientales del profesorado de primaria en formación inicial: estudio de caso. Revista Enseñanza de las Ciencias, 36, (1), 117-141.

[30] Novo; M. 1996, La Educación Ambiental formal y no formal. *Iberoamericana de Educación, 11*.

[31] Rönnbäck, P; Troell, Max, K; and Primavera, J. H. 1999, Distribution Pattern of Shrimps and Fish AmongAvicenniaandRhizophoraMicrohabitats in the Pagbilao Mangroves, Philippines. *Estuarine, Coastal and Shelf Science, 48*(2), 223-234.

[32] Jiménez, J. A. and Soto, R., 1985. Patrones regionales en la estructura y composición florística de los manglares de la costa Pacífica de Costa Rica. *Revista de Biología Tropical, 33*(1), 25-37.

[33] Milenio., 2005, Evaluación de los Ecosistemas. Los ecosistemas y el bienestar humano: humedales y agua. Informe de Síntesis: World Resources Institute Washington, DC, EUA.

[34] Pastrana, C. M., González, M; Licea, A.,Santamaría, F; Av, A; Sarti, l., 2003, Colorada, Playa Tortuguera Tierra. Ficha Informativa de los Humedales de Ramsar (FIR).