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Artículos Científicos

Educación sustentable no formal para conservar los manglares en zonas costeras con estudiantes de Sociología, UAGro

Non formal sustainable education to conserve mangroves in coastal areas with students of Sociology, AUGro

Educação sustentável não formal para conservação de manguezais em áreas costeiras com estudantes de Sociologia, UAGro

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Resumen

Ante la crisis ambiental surge la importancia de la educación. Las universidades tienen el compromiso de fomentar la sustentabilidad, de ahí que sea necesario que la dimensión ambiental figure en el currículo para desarrollar iniciativas transversales y actividades que contribuyan no solo a comprender la crisis ambiental, sino también a intervenir en ella con estrategias. En tal sentido, la presente investigación (desarrollada entre enero y septiembre de 2019) tuvo el propósito de identificar la dimensión ambiental en el plan de estudio de la Escuela Superior de Sociología (PEESS) dependiente de la Universidad Autónoma de Guerrero (UAGro) para luego implementar y evaluar un curso-taller no formal sobre educación ambiental, el cual estuvo enfocado en el tema de la conservación de los manglares.

En síntesis, fue un estudio mixto, con un enfoque de investigación-acción que se contempló en tres fases: en la primera se realizó un diagnóstico para identificar la dimensión ambiental en el currículo, para lo cual se aplicó una entrevista diseñada con variables como inclusión de la dimensión ambiental en el PEESS, percepción de la crisis ambiental, importancia de la educación ambiental y manglares. La segunda fase comprendió el diseño y elaboración con su respectiva planeación didáctica del curso-taller. Para este se siguió una metodología constructivista y de competencias. Las temáticas que se definieron fueron educación ambiental y conservación de los manglares. La tercera fase estuvo conformada por la aplicación y evaluación del referido curso-taller.

Los resultados indican que en el PEESS escasamente se integra la dimensión ambiental debido a que las unidades de aprendizaje que lo conforman no vinculan dicha temática con sus objetivos. La universidad, por tanto, debe incorporar en sus planes de estudio la educación ambiental como tema transversal no formal, de manera que los estudiantes promuevan competencias ambientales para enfrentar con propuestas de solución las problemáticas ambientales actuales. En la segunda fase, fue posible preparar un curso-taller sobre Educación Ambiental para conservar los manglares con una base científica, contempló dos sesiones, actividades y métodos de evaluación y en la tercera fase se asistió a la aplicación y evaluación realizada. Ello permitió saber que el aprendizaje y los aprendizajes en educación Ambiental para conservar los manglares fueron adquiridas.

El Modelo Educativo de la UAGro establece la sustentabilidad y, por tanto, la introducción de temas transversales como el medio ambiente y otros temas. Sin embargo, el PEESS apenas contempla esta dimensión. Autores como Yanez y Álvarez (2019) afirman que distintos países

deben incorporar el principio de transversalidad curricular en la enseñanza de la Educación Ambiental para el desarrollo sostenible a través de sus sistemas educativos. Linares, Tovilla y De la Preza (2004a) consideran que la Educación Ambiental es necesaria para ayudar a crear conciencia sobre el problema que afecta a los manglares en la actualidad. También establecen que, a través de talleres para la protección de los manglares, se ha logrado involucrar a algunas personas sobre el aprovechamiento del manglar y sus recursos.

Palabras clave: educación ambiental no formal, manglares, socioambiental, sustentabilidad.

Abstract

Faced with the environmental crisis, the importance of education arises. Universities have the commitment to contribute to sustainability, it is necessary that the environmental dimension is included in the curriculum, so that this dimension implies developing environmental issues in a transversal way, or activities that contribute to understanding the socio-environmental reality for students to analyze the environmental crisis and intervene with strategies, however, sometimes, the curricula are not environmentalized or do not integrate cross-cutting issues such as the environment, and it is necessary to go to non-formal Environmental Education (EE) for this reason, non-formal intervention educational programs are designed and thus contribute to the sustainability that is required. The research was carried out in January-September 2019 and its purpose was to make a diagnosis to identify the presence of the environmental dimension in the Study Plan of the Higher School of Sociology (SPHSS) under the Autonomous University of Guerrero (AUGro) and Implement and evaluate a non-formal workshop-course on Environmental Education aimed at the conservation of mangroves with a socio-environmental approach for students of that institution. The Educational Model of the UAGro establishes sustainability as a guiding principle, however, the (SPHSS) contemplates very little to the environment or said principle.

It was a mixed study, with a focus on action research and descriptive, contemplated three phases, a diagnosis to identify the environmental dimension in the curriculum, therefore, an interview was conducted with students, with variables (inclusion of the environmental dimension in the SPHSS, perception of the environmental crisis, importance of EE and the mangroves), the second phase included the design and elaboration with their respective didactic planning of the course-workshop, a constructivist and competency methodology was followed, the themes that were defined were Environmental Education and the conservation of mangroves, the third included the application and evaluation of the course-workshop in question.

The results indicated that the SPHSS scarcely integrates the environmental dimension, because the learning units that conform it do not link the environmental theme with their objectives, the teachers do not have the competences in that field, the students do not promote environmental competencies among others. In the second phase, it was possible to prepare a workshop-course on Environmental Education to conserve mangroves with a scientific basis, contemplated two sessions, activities and evaluation methods and in the third phase, "application and evaluation" was attended by seventy students from different grades that attended the training, the evaluation carried out, allowed to know that learning and skills were acquired in EE and to protect and conserve mangroves.

The Educational Model of the AUGro establishes sustainability and, therefore, the introduction of cross-cutting issues such as the environment and other themes. However, the (PEESS) very scarcely contemplates this dimension. Authors such as Yanes and Alvarez (2019) state that different countries must incorporate the principle of curricular mainstreaming in the teaching of environmental education for sustainable development through their educational systems. Linares, Tovilla and De la Presa (2004a) considered that environmental education is necessary to help raise awareness about the problem affecting mangrove forests today, they also comment that, through workshops for the protection of mangroves, it has been managed to involve some people for a rational use of man and his resources.

Keywords: Non-formal Environmental Education, mangroves, socio-environmental, sustainability.

Resumo

Diante da crise ambiental, surge a importância da educação. As universidades estão comprometidas em contribuir para a sustentabilidade, é necessário que a dimensão ambiental seja incluída no currículo, para que essa dimensão implique o desenvolvimento de questões ambientais de forma transversal, ou atividades que contribuam para a compreensão da realidade socioambiental para os alunos analisarem a crise ambiental e intervirem em estratégias; no entanto, às vezes, os currículos não são ambientalizados ou não integram questões transversais, como o meio ambiente, e é necessário ir para a Educação Ambiental não formal Por esse motivo, programas educacionais de intervenção não formal são projetados e, assim, contribuem para a sustentabilidade necessária. A pesquisa foi realizada no período de janeiro a setembro de 2019 e teve como objetivo diagnosticar a presença da dimensão ambiental no Plano de Estudos da Escola Superior de Sociologia (PEESS)

da Universidade Autônoma de Guerrero (UAGro) e Implementar e avaliar um curso não formal de educação ambiental voltado para a conservação de manguezais, com uma abordagem socioambiental para os alunos daquela instituição. O Modelo Educacional da UAGro estabelece a sustentabilidade como princípio norteador, no entanto, o (PEESS) contempla muito pouco o meio ambiente ou o referido princípio.

Foi um estudo misto, com foco em pesquisa-ação e descritivo, contemplado três fases, um diagnóstico para identificar a dimensão ambiental no currículo, portanto, foi realizada uma entrevista com os alunos, com variáveis (inclusão da dimensão ambiental no currículo). (PEESS, percepção da crise ambiental, importância da EA e manguezais), a segunda fase incluiu o desenho e a elaboração do respectivo planejamento didático do curso-workshop, seguiu-se uma metodologia construtivista e de competência, os temas definidos foram Educação Ambiental e conservação de manguezais, a terceira incluiu a aplicação e avaliação do workshop-curso em questão.

Os resultados indicaram que o PEESS mal integra a dimensão ambiental, porque as unidades de aprendizagem que o conformam não vinculam o tema ambiental aos seus objetivos, os professores não possuem competências nesse campo, os alunos não promovem competências ambientais entre outros . Na segunda fase, foi possível preparar um curso de oficina sobre Educação Ambiental para conservar manguezais com base científica, contemplou duas sessões, atividades e métodos de avaliação e na terceira fase, "aplicação e avaliação" foram assistidas por setenta alunos das diferentes séries que participaram do treinamento, a avaliação realizada permitiu saber que o aprendizado e as habilidades foram adquiridos na EA e proteger e conservar os manguezais.

O Modelo Educacional da UAGro estabelece sustentabilidade e, portanto, a introdução de questões transversais como meio ambiente e outros temas, mas o PEESS mal contempla essa dimensão. Autores como Yanes e Álvarez (2019) afirmam que diferentes países devem incorporar o princípio da integração curricular no ensino da educação ambiental para o desenvolvimento sustentável por meio de seus sistemas educacionais. Linares, Tovilla e De la Presa (2004a) consideraram que a educação ambiental é necessária para ajudar a aumentar a conscientização sobre o problema que afeta hoje as florestas de mangue, eles também comentam que, através de oficinas para a proteção de manguezais, tem sido conseguiu envolver algumas pessoas para um uso racional do homem e de seus recursos.

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Palavras-chave: Educação Ambiental Não Formal, sustentabilidade, manguezais, socioambientais.

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Introduction

The work that is now presented has as background the educational model of the Autonomous University of Guerrero, which focuses on sustainability as one of the fundamental principles to promote quality education. This emphasizes environmental issues with a socio-environmental approach, this is due to the climate crisis that occurs throughout the planet. In this sense, it has been determined that the curricula of the educational levels taught in the aforementioned institution must integrate emerging issues such as poverty, gender perspective, the environment, among others, through a transversal method. That said, the present investigation is justified because with this one tries to know the integration of the environmental dimension in the curricula.

As is known, the environmental problem is increasing, especially with regard to biodiversity. Mangroves, for example, are plants that are usually born in coastal areas and provide sufficient benefits; however, people are intervening in their deterioration, so it is necessary that knowledge, skills and values be disseminated for their protection and conservation.

The conservation of our coastal ecosystems requires that students, the inhabitants of those areas and the general public have more information about them. Today, given the scenarios of climate change and disasters that have affected coastal residents, this requirement becomes even more relevant. Raising awareness among the population will allow greater contact between citizens and nature (Moreno-Casasola e Infante, 2016).

Mangroves in Mexico are distributed inside coastal lagoons and deltaic 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 (López and Escurra, 2002).

Mexico is a privileged country for its biodiversity, hence it occupies the first places in all the lists referring to this aspect. Biodiversity, according to Díaz (2011), covers three levels of expression of biological variability: ecosystems, species and genes. For the aforementioned author (2011), mangroves - regionally known as mangroves - are located in the ecosystem consisting of trees or shrubs that grow in the coastal areas of tropical and subtropical regions. Mangroves are

called mangrove forests, present in tropical and subtropical regions of the world (Wolanski, cited by Mera, 1999). They are a group of highly evolved halophytes that grow in the strip located on the border between marine waters and the mainland, usually in the area between tidal estuaries, lagoons and coastal swamps, hence they frequently flood with seawater during high tides (Gang y Agatsiva citados por Mera, 1999).

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 (Rodríguez et al., 2018). According to González (May 18, 2018), the word mangrove is extracted from the mangrove. A mangrove is a biome that is also called salty forest or coastal wetland, which is found in tropical and subtropical areas, especially in swampy and waterlogged soils. Currently, a variety of mangroves can be numbered, 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 white, red, black and gray mangroves (although there are actually about 70 tree species of this family). Similarly, a different typology can be determined by the location of the mangrove. 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.

For López et al. (cited by Valderrama et al., 2017), 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 which 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 these species (Avicennia bicolor and Rhizophora harrisonii), on the other hand, have a very restricted distribution, with the presence of only some isolated populations in the states of Chiapas and Oaxaca.

According to the Food and Agriculture Organization of the United Nations (FAO) (cited by Valderrama et al., 2017), this ecosystem is especially important, as it provides widely known environmental benefits, such as flood control, protection against hurricanes, a source of nutrients

for neighboring ecosystems such as coral reefs and capture of greenhouse gases, among many others. Over the past two decades, the importance of mangrove conservation and protection has increased substantially worldwide and nationally. According to information from the Ministry of Environment and Natural Resources (Semarnat) (2016), Mexico ranks fourth in the world in coastal wetlands after Indonesia, Brazil and Australia.

Mangroves provide important environmental services such as flood protection and regulation, aquifer recharge, water quality improvement by serving as a biological filter, prevention and reduction of coastal erosion, water quality regulation and carbon sequestration . In other words, they constitute feeding, shelter and growth zones for crustaceans, fry and other species of flora and fauna.

In the mangrove forests of the Mexican coast there are five species of mangroves, of which Rhizophora mangle L. (red mangrove), Avicennia germinans L. (black mangrove or mangrove prieto), Laguncularia racemosa (L.) Gaertn are most abundant (white mangrove) and Conocarpus erectus L. (mangrove button). Also, lately, Rhizophora harrisonnii Leechman in the state of Chiapas (Rico-Gray *et al*., citados por Aguirre, 2018).

The environmental issue

Nowadays it is repeated until wearyness that the global environmental crisis, with its different variables (such as climate change and the loss of biodiversity, among others), is the "greatest threat" that has affected humanity in its history (Estenssoro, 2018). According to Garrido et al. (2007) cited in Ramírez (2015), this crisis is expressed in specific events, such as the greenhouse effect, the hole in the ozone layer, the emptying of fossil fuels, deforestation, overexploitation and depletion of water resources , air pollution, acid rain, erosion, among other phenomena. In other words, biodiversity is threatened by several processes (mostly anthropogenic, which transform the environment in which we live). Among them, the following may be mentioned: 1) invasive species and 2) habitat loss and fragmentation. The latter is considered the primary cause of the loss of biodiversity at all levels, and arises mainly due to changes in land use for agriculture, livestock, aquaculture, etc., a phenomenon caused by population expansion and human activities (Plascencia, Castañón and Raz-Guzmán, 2011).

Environmental problems are driven by driving forces such as land use changes (livestock, illicit crops and infrastructure), the decrease, loss and degradation of elements in native ecosystems and agro-ecosystems (agribusiness, mining, hydroelectric, urbanization and overexploitation of

fish), water pollution (mining and pesticide use) and climate change (MADS and UNDP cited by Ramírez, 2015).

In the last 50 years, the world's mangroves have been cut in half. These coastal ecosystems have the ability to store more carbon than many tropical forests. Even so, they are being rapidly destroyed from the coast, emitting huge amounts of greenhouse gases (Heir, April 15, 2011). 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% (Olguín, Hernández y Sánchez, 2007).

Greenpeace (2009) points out that in our country the mangrove area is disappearing at an annual rate of 2.5%, while, globally, FAO reports a loss rate of this ecosystem of 0.66%. Alejandro Olivera, campaign coordinator of Greenpeace Mexico, said in a note published in 2019 on the Greenpeace page that "It is necessary to prevent mangroves from being destroyed in exchange for economic compensation and prevent the construction of unsustainable resorts that only leave benefits in the short term and to 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), 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 coastal areas (FAO cited by Uribe and Urrego, 2009).

Arroyo, Camarero and Vásquez (cited by Yépez, 2018) point out that "man while remaining an element of the natural environment is becoming a factor that depends on the functioning of most ecosystems and even their conservation" (p. 89). Therefore, living and enjoying a natural environment makes the neighbor who sees him day by day in an ecological entity, hence he must preserve this environment. Álvarez and Vega (cited by Yépez, 2018), and referring to individuals, explain that they only develop environmentally consistent behaviors if they are trained "on the environmental problem, are motivated towards it and, in addition, are able to generate qualitative

changes , they are convinced of the effectiveness of their action and that this will not generate significant difficulties, if it is assumed that the training referred to by the author is to acquire knowledge" (p. 89).

Sustainable development

Sustainable development implies a new vision of the world and of relating to nature, which implies transformations in different areas, such as scientific, technological, social, political, economic, cultural and educational (Calixto, 2018). Therefore, "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" (Vega cited by Molano and Herrera, 2014, p. 192) . In other words, education is an important tool to contribute to sustainable development.

Environmental education for sustainability

Education means a process of continuous sociocultural development of the capacities that people in society must generate, which is carried out both within and outside their environment throughout life. Education implies promoting cognitive skills and structures that allow sensory stimuli and world-reality perception to become meaningful information in knowledge of its construction and reconstruction, as well as values and customs that determine our behaviors (Álvarez cited by Martínez Castillo, 2010). The environmental crisis has reached such an alarming level that it is now due, through education, to raise awareness of the importance of changing forms of production and social welfare, as well as respect for cultural diversity and the conditions that enable existence of life on the planet. In this context, the significance of environmental education becomes evident as one of the alternatives for the recognition of the conservation value of the planet's natural conditions (Calixto, 2015). At present, environmental education is spoken of as the most effective means of raising public awareness of the need to preserve the environment with a view to achieving a better quality of life for current generations and to come.

However, the concept of environmental education was first used in Stockholm (Sweden) in 1972 during the International Conference on the Environment, and since then it has been given the preponderance to generate changes through the acquisition of knowledge, attitudes and values that allow to face seriously the environmental crisis of the world (Sereviche-Sierra, Gómez-Bustamante and Jaimes-Morales, 2016).

Then, at the end of the 1980s and the first half of the 1990s, the term environmental education not only began to be linked to sustainable development, but was also defined as follows:

> 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. (González, 1996, p.27).

Environmental education, therefore, must teach how development can continue while the life support systems of the planet are protected and conserved, and in that sense the culture for the conservation and rehabilitation of mangrove forests requires greater Attention. Education, in effect, 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 rationally use the ecosystem (Linares, Tovilla and De la Presa, 2004). Environmental education, in a nutshell, is essential to help raise awareness about the problem facing mangrove forests today (Linares, Tovilla and De la Presa, 2004).

Formal and non-formal environmental education

Currently, it is necessary to create bridges between environmental education that is developed in school settings (formal education) and that promoted by non-governmental organizations, environmental groups, municipalities and autonomous communities (non-formal education), since both are part of the same system of reciprocal thought and action (Novo, 1996).

In this sense, and as mentioned before, the objective of this research was to develop a non-formal workshop-course on environmental education in order to promote awareness about the conservation of mangroves. This initiative (framed within the principles of informal education) was designed to complement the activities generated within a formal education curriculum. In short, an attempt was made to diagnose the presence of the environmental dimension in the Study Plan of the Higher School of Sociology (PEESS) under the Autonomous University of Guerrero (UAGro).

Materials and methods

This work was carried out under a mixed approach because techniques and instruments of the quantitative and qualitative methodology were considered. In this regard, Osses, Sánchez and Ibáñez (2006) point out that qualitative research is aimed at the in-depth study of the complex social reality. Likewise, and because a variety of consultation sources (printed, electronic, etc.) were reviewed and data were collected at the place where the study was conducted, this research can also be considered as documentary and field.

Similarly, and as there were participating subjects that were part of the object of study, this work also has a research-action approach. Martínez (2006) states that this method is the only one indicated when the researcher not only wants to know a certain reality or a specific problem of a group, but also wants to solve it. In the words of Colmenares and Piñero (2008), action research is a qualitative methodological option in education. Finally, it should be emphasized that quantitative methods are contemplated in this study because instruments of that nature were applied.

Population and sample

Table 1 describes the population and sample considered in this research process:

Tabla 1. Población y muestra seleccionadas

Población general en la Universidad Autónoma de Guerrero		Universo de estudio	Población de la Escuela de Sociología	Muestra (participantes en el diagnóstico, previo al curso-taller)	Muestra (participantes en el curso-taller de educación ambiental para la conservación de manglares)	Enfoque de selección de la muestra y edad de los participantes
Universidad Autónoma de Guerrero, México	*Profesores (1162) 383 mujeres 779 hombres	Escuela de Sociología	**17 (15 hombres, 2 mujeres) profesores y 238 (96 hombres-142 mujeres) estudiantes de sociología	115 estudiantes de los grupos, 201, 202, 401,402, 601, 602 (turnos: matutino y vespertino)	70 estudiantes de los grupos 201, 401,601 y 801 del turno matutino asistieron al primer y segundo taller	Cualitativo y por conveniencia. La edad de los estudiantes oscila entre 18-23 años

Fuente: Elaboración propia con datos del *Anuario Estadístico 2013-2014, 2014-2015 y **2016-2017 de la Universidad Autónoma de Guerrero

Techniques, procedure and instruments used

The research was developed in three phases:

Phase a: Diagnosis to identify the inclusion of environmental issues with a sustainable focus in the curriculum

A diagnosis was made with sociology students to identify the inclusion of the environmental dimension and sustainability in the sociology curriculum, as well as the perception of environmental issues and the care of biodiversity and mangroves. An interview was conducted with variables and indicators (inclusion of the environmental dimension and sustainability in the curriculum, perception of the environmental crisis, importance of environmental education for biodiversity and mangroves) applied to 115 students, including men and women from Different academic degrees.

Phase b: Pedagogical-didactic design of the course-workshop

The didactic sequence that established the planning on the set of educational strategies, didactic activities and methods of evaluation of learning for the course-workshop Environmental education for the conservation of mangroves was designed.

Phase c: Application and evaluation of the workshop course.

The Environmental Education course-workshop for the conservation of mangroves was applied and evaluated. During this, diagnostic, continuous and final evaluations were carried out to detect the learning and skills acquired.

Results

Phase a: Diagnosis to identify the inclusion of environmental issues with a sustainable focus in the curriculum

Considering the sample selection approach (qualitative and for convenience), 115 students between men and women were chosen for the interview application. In this regard, it is worth mentioning that the school has two groups per grade: one in the morning and one in the afternoon (in each semester of the year). The survey was answered by 22 students of group 201 (morning shift), 13 of group 202 (evening shift), 14 of group 401 (morning shift), 13 of group 402 (evening shift), 18 of group 601 (morning shift) , 10 from group 602 (evening shift), 10 from group 801 (morning shift) and 15 from group 802 (evening shift).

The objective of the interview was to identify the inclusion of the environmental dimension in the sociology curriculum to determine the perception of environmental problems (specifically the care of biodiversity and mangroves). In total, 17 questions were formulated, which were grouped into the following categories: inclusion of the environmental dimension and sustainability in the curriculum, perception of the environmental crisis and importance of environmental education for biodiversity and mangroves.

Inclusion of the environmental dimension and sustainability in the curriculum

All respondents stated that they did not know what the concepts of sustainable development or sustainability were referring to. Specifically, 5% relate their response to the environment or to take care of the environment and resources, although it is also worth noting that in other cases they referred to aspects that are not related to the aforementioned concepts. Also, 10% of respondents relate these terms to development, environment and social issues.

Regarding the incorporation of the environmental or environmental dimension in the study plan, more than 100 respondents commented that it is not incorporated; In addition, 5% commented that this dimension could be integrated into the curriculum through conferences or presentations related to environmental issues. When asked if the subjects studied were related to the environmental dimension, 98% answered negatively, while only 3% said that this happened only on some occasions.

Perception of the environmental crisis

Faced with the question: Does it explain how environmental problems affect social development and, therefore, sustainable? In fact, only 10% perceived that environmental problems were an issue that should be addressed urgently, while another 10% related existing pollution to various health effects. In short, 98% said that the learning units or subjects were not linked to the environmental crisis.

Importance of environmental education for biodiversity and mangroves

The 115 students consulted were of the opinion that it was very important to care for and preserve plants and animals due to the danger of extinction to which they were exposed, although in relation to the mangroves they said they did not know much about it.

Likewise, and with other questions (e.g., do you think it is important to promote Environmental Education competencies? And do you think it is important to take courses-workshops that address environmental issues such as the conservation of mangroves?), 115 students answered affirmatively, because they considered, in addition, that the career they were studying did not touch on these topics. In addition to this, everyone felt that the environmental dimension must be present in the school curriculum to have competencies that allow facing and addressing this environmental problem that could affect social development.

Phase b: Pedagogical-didactic design of the course-workshop

Nieto and Buendía (2008) establish that one of the phases of the design of an environmental education project for sustainability is contextualization; This consists of characterizing the network of the most significant relationships that exist between the project environment where it is expected to have a certain contribution and impact and the basic elements of the educational project (that is, contents, objectives, activities, etc.).

Once the contextualization is completed, we proceed to the planning of specific activities (didactic sequence). The design and elaboration of a didactic sequence implies adopting a didactic-pedagogical and methodological approach to plan the development of the topics that correspond to the course or workshop, as well as the strategies, forms of evaluation, etc. In Oxford Dictionaries (2019) the word design is defined as a detailed plan for the execution of an action or an idea. Also, the word design is considered as a creative activity that aims to project objects that are useful.

Planning, therefore, is associated with a rational and structured guide that takes into account what you want to achieve, what you want to convey, how it will be done, how you can react in case of any unforeseen event, what resources they are needed and how the activity can be evaluated (Ruiz, sf).

However, the theoretical support of this didactic sequence is found in the work of Tobón, Pimienta and García (2010), who offer a general standard methodology for planning activities by competences from a socioformative approach. The format used was an adaptation of the one used at the Autonomous University of Guerrero in didactic planning of degree level.

The workshop-course was based on the principles of constructivism and skills education. Constructivism postulates that knowledge is acquired when a person constructs meanings interacting intentionally with other people. The competitions build the best performance in the students to respond to the demands of the environment (Cuevas, Rocha, Casco and Martínez, 2011). Table 2 describes the educational strategy implemented in the two sessions of the workshop-course.

Tabla 2. Estrategia educativa de la sesión 1 y 2 del curso-taller, *Educación Ambiental para la conservación de manglares:*

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Sesión Fecha Eje integrador	Actividades de aprendizaje		Evaluación			Recursos de aprendizaje
	Actividades con el docente (tiempo)	**Actividades de aprendizaje independiente**	**Criterios (aprendizajes esperados)**	**Evidencias**	**Ponderación**	
Sesión 1 (28 de mayo de 2019) Educación ambiental para la sustentabilidad	Técnica: Lluvia de ideas El facilitador pide a los estudiantes que mencionen las problemáticas ambientales que conozcan. **Tiempo:** 15 minutos El facilitador pregunta qué entienden por educación ambiental. **Tiempo:** 15 minutos El facilitador expone la conferencia sobre educación ambiental (problemática ambiental, educación ambiental, su historia, enfoques metodológicos y estrategias). El facilitador realiza preguntas sobre lo expuesto. **Tiempo:** 1 hora. El facilitador desarrolla una estrategia didáctica que consiste en integrarse en equipos para realizar un sociodrama sobre algún problema ambiental dentro o fuera de la escuela. El sociodrama es actuado y grabado en video (con el teléfono celular). Se envían los videos al facilitador, se presentan en la clase y se hacen comentarios. **Tiempo:** 2 horas. Los estudiantes contestan un instrumento de evaluación sobre	Investigar en fuentes confiables de internet qué son los manglares.	Comprensión, análisis e identificación de estrategias de educación ambiental para intervenir ante una problemática ambiental.	Preguntas sobre las problemáticas ambientales. Preguntas sobre la educación ambiental (su historia, enfoques y estrategias). Práctica del sociodrama sobre un problema ambiental. Evaluación final de la sesión 1.	50 %	Bibliografía sobre educación ambiental recomendada para esta sesión.

	aprendizajes adquiridos durante la sesión. **Tiempo:** 30 minutos					
	Tiempo: 4 horas	**Tiempo:** 2 horas				
Sesión 2 (13 de junio de 2019) Educación ambiental para la conservación de los manglares.	Con respecto a la tarea de la sesión anterior, referida a los manglares, se solicita a los estudiantes su investigación acerca de los mangles. **Tiempo:** 30 minutos. El facilitador aplica un instrumento diagnóstico a los estudiantes para determinar cuáles son sus conocimientos sobre el tema de manglares. **Tiempo:** 1 hora El facilitador expone la conferencia *Educación ambiental para la conservación de los mangles en zonas costeras* (qué son, tipos, dónde crecen, beneficios e importancia en el medio y la comunidad, etc.). Realiza preguntas, se hacen comentarios, etc. **Tiempo:** 1 hora. Aplicación de técnica: De manera grupal, plantean compromisos para cuidar y preservar el medio ambiente, la biodiversidad y principalmente los ecosistemas de manglar. **Tiempo:** 1 hora. El facilitador aplica por segunda vez el instrumento diagnóstico que tuvo como finalidad conocer los conocimientos que tenían los estudiantes sobre los manglares para comparar los aprendizajes adquiridos en el curso. **Tiempo:** 30 minutos.	Implementar lo aprendido en la vida cotidiana.	Analizar la importancia de la educación ambiental para conservar los manglares por lo que representan.	Se recibe la tarea de sesión anterior. Diagnóstico de conocimientos previos sobre manglares. Preguntas y comentarios con respecto a la conferencia. Compromisos para cuidar el medio y los manglares. Evaluación final de la sesión (segunda aplicación del instrumento de conocimientos previos).	50 %	Bibliografía de educación ambiental y manglares para esta sesión.

Fuente: Elaboración propia

Phase c: Application and evaluation of the workshop course

The workshop-course was called Environmental Education for Sustainability and for Mangrove Conservation and was developed in two sessions: the first on May 28, 2019, and the second on June 13, 2019. 70 students attended.

In the first session the previous knowledge of the participants regarding environmental education was diagnosed. The answers provided by the group were recorded by the facilitator and grouped according to the criteria in table 3:

Tabla 3. Evaluación grupal de conocimientos previos sobre la problemática ambiental y la educación ambiental

Criterios		Excelente	Satisfactorio	Poco satisfactorio	Totalmente insatisfactorio
	Reconoce las problemáticas ambientales.			X	
	Comprende el concepto *educación ambiental*			X	
	Identifica las problemáticas ambientales globales y locales.			X	
	Relaciona la educación ambiental solo con naturaleza	X			
	Relaciona la problemática ambiental como un elemento que afecta al medio e impide la sustentabilidad.				X
	Relaciona la educación ambiental con una herramienta para lograr la sustentabilidad				X
	Resultado final: Las respuestas aportadas (conocimientos previos) fueron superficiales.				

Fuente: Elaboración propia

Continuing with the first session, from 10:30 to 11:30, the facilitators presented at Power Point the conference on environmental education (environmental issues, its history, methodological approaches and strategies), which took place in three phases (at the end of each one, questions and comments were made). In the first part of the conference a general reflection on environmental education was offered: background, main approaches and strategies that can be implemented to act responsibly. It was also announced that the issue of environmental education has been one of the most discussed in international forums from 1970 to the present.

Then there was a brainstorm based on questions such as the following: what can be said about environmental education and its importance? What work approach does this concept pose and what strategies and actions could be implemented to have a means healthy environment ?, what would be the global and local environmental problems and how these impact on economic and social development ?, how important is having a healthy environment both natural and urban?

These questions served to raise awareness among participants about the purposes of environmental education and how this concept is decisive not only for caring for nature, but also for contributing to sustainable development. Regarding the care of a healthy environment, they commented that clean spaces should be kept and avoid contaminating them, for which the strategies offered by environmental education are indispensable.

In the second part of the conference the causes of environmental problems and the identification of strategies that could be developed were discussed; Some problems that have their origin in anthropogenic activities were also discussed and some methods, actions or strategies that can be implemented to reduce or minimize the effects that man produces on the environment were presented. At the end of this part of the conference, the following question was asked to the attendees: what are the main causes of pollution? The responses emphasized plastics, overpopulation, consumerism, fires and deforestation by felling trees. Some of the doubts that arose among the students were these: how can we stop the activities carried out by man on the environment? What can we do as individuals before large corporations? How can consumerism be reduced if we are bombarded? with products ?, how to make politicians change and enforce environmental laws ?, among others. Some proposals that arose from these reflections were the following: implement reforestation when trees are cut down and promote by the Government policies that regulate the contamination of factories, cars, etc.

The third part of the conference focused on an introduction to urban solid waste (MSW), its regular management and its desired management. For this, the stages of an environmental education program (diagnosis, strategy definition, planning and evaluation) were analyzed. Likewise, an analysis was made of the strategies, as well as the structure of an environmental education program and its main trends and models in the school system. At the end, the following questions were asked: what are the MSW and how can they be manipulated (disposal and importance of recycling), what are the environmental education programs and what is their purpose?

The responses allowed us to identify that the students do not have an adequate culture on the management of MSW, although they stressed that the garbage should be left in appropriate places. In addition, they noted that the waste could be classified before taking it to the warehouse.

From 11:30 a.m. to 1:30 p.m. - based on the information from the conference - a group activity was promoted to carry out a socio-drama about some environmental problem detected inside or outside the school, for which they also had to propose some solution. The students acted in the sociodrama, recorded it with their cell phones and sent it to the facilitator. In this activity, only three groups of five people could be formed because the other students preferred to observe the participation of their classmates. The topics chosen were air pollution, urban solid waste generation and improper use of water. Subsequently, the teams left the classroom to locate the problem, dramatize and record it. After the activity, they returned to the classroom and sent the videos to the facilitator to be screened in the classroom.

In general, the creativity of the participants was observed, since each socio-drama was different: two of the teams represented the work through reports, while the issue of water was treated as a day-to-day situation in the school (lack of water, waste, etc.). The argument was fully consistent with the theme developed in the session and the principles of the strategies were properly applied. During the presentation of the videos, the students reflected on the problems detected and made comments and questions.

This activity was evaluated through a rubric that relied on the following criteria: collaborative work, plot, dramatization, creativity and presentation. Each criterion was evaluated with excellent (4), good (3), regular (2) and bad (1). In general, it can be said that the activity served its purpose.

In the hours from 1:30 p.m. to 2:00 p.m., the students answered a group assessment instrument about the lessons learned. Some questions were asked about the topics that were

developed in this session to gather general information about the lessons learned and skills acquired. The results are described in Table 4 below:

Tabla 4. Evaluación grupal de conocimientos adquiridos en la primera sesión del programa

Criterios		**Excelente**	**Satisfactorio**	**Poco satisfactorio**	**Insatisfactorio**
	Reconoce las problemáticas ambientales.	X			
	Comprende el concepto *educación ambiental*.	X			
	Identifica las problemáticas ambientales globales y locales.	X			
	Relaciona la educación ambiental solo con naturaleza.			X	
	Relaciona la problemática ambiental como un elemento que afecta al medio e impide la sustentabilidad.	X			
	Relaciona la educación ambiental con una herramienta para lograr la sustentabilidad.	X			
	Promueve actitudes y aptitudes responsables ante el medio.	X			
	Pondré en marcha estrategias para cuidar el medio ambiente.	X			
	Es importante implementar programas de educación ambiental	X			
	Conoce ahora el propósito de la educación ambiental.	X			

	Resultado final: Las respuestas en cuanto a los conocimientos previos fueron superadas; ahora se comprende que los estudiantes lograron adquirir aprendizajes y competencias sobre la temática que trató la sesión.

Fuente: Elaboración propia

At the end of the first session an activity was assigned to be presented in the next. The job requested was to investigate the definition of mangroves in reliable Internet sources.

Results of the second session

The second session was held on June 13, 2019 with an attendance of 70 students. The name of this second session was Environmental Education for Mangrove Conservation, which lasted four hours (from 10:00 a.m. to 2:00 p.m.). From 10:00 a.m. to 10:30 a.m., students were asked to assign the mangroves:

Tabla 5. Evaluación de conocimientos previos sobre los manglares

Criterios		**Excelente**	**Satisfactorio**	**Poco satisfactorio**	**Insatisfactorio**
	¿Qué son los mangles?			X	
	Lugar donde se reproducen, tipos, beneficios.			X	
	Problemática que atraviesan los mangles.			X	
	Medidas de protección y conservación.				X
	Resultado final: Los conocimientos previos sobre los manglares son muy ambiguos, superficiales y escasos.				

Fuente: Elaboración propia

In the hours from 10:30 to 11:30, the facilitators applied an open interview to the students to identify their knowledge of the mangroves. The questions asked appear in table 6. The answers were analyzed qualitatively in a group manner and organized into measurement indicators (excellent, satisfactory, unsatisfactory and unsatisfactory):

Tabla 6. Instrumento sobre indagación de los manglares y su conservación

Preguntas	Excelente	Satisfactorio	Poco satisfactorio	Insatisfactorio
¿Sabe usted qué es un manglar?			X	
¿Cuál es su función en el medio ambiente?				X
¿Cuántos tipos de especies de manglar existen en México y en Guerrero, principalmente?				X
¿Conoces algún reglamento o ley que regule la protección y conservación del ecosistema de manglar en México y en Guerrero, principalmente?				X
¿Qué hace la institución donde laboras o estudias para proteger y conservar los manglares?				X
¿Cuál es la problemática asociada al impacto antropogénico en los manglares?			X	
¿Cuáles son las consecuencias del deterioro de los ecosistemas de manglar?			X	
Mencione el beneficio de los manglares en el aspecto ecológico, social y económico.				X
¿Las personas pueden explotar los manglares por cuestiones de siembra o algún otro beneficio? ¿Por qué?				X
Mencione algunas medidas para la protección y conservación del ecosistema de manglar.			X	
¿Considera usted importante implementar programas de educación ambiental para la protección y conservación de los manglares en Guerrero? ¿Por qué?	X			

¿Qué temáticas considera y sugiere usted que deben incluirse en los talleres que contemple el Programa de educación ambiental para la protección y conservación de la biodiversidad?	X				
	Resultado final: Las respuestas de los estudiantes sobre las preguntas planteadas fueron ambiguas; sin embargo, se aprecia que en las interrogantes relacionadas con el taller de la sesión 1, las respuestas son más completas.				

Fuente: Elaboración propia

From 11:30 to 12:30, the facilitators presented the conference Environmental education for the conservation of mangroves in coastal areas (what are they, types, where do they grow, benefits and importance in the environment and the community, etc.) . At the end, questions were asked and comments were requested on the topics discussed. In summary, the participants felt that the issue of environmental education is vital to conserve mangrove ecosystems, especially in the state of Guerrero.

Then, between 12:30 and 13:30, students were asked to write their commitments for the care of these ecosystems. The proposals presented focused on the preservation of mangroves due to their importance for the environment and for other social aspects.

From 1:30 p.m. to 2:00 p.m., the facilitator applied the instrument for the second time (related to the questions in table 5) to compare the knowledge acquired by the students after the workshop-course. In general, it can be said that all participants became more aware of the care and preservation of mangroves.

Discussion

The institution's curriculum

In the first place, it was possible to indicate that the inclusion of the environmental dimension and sustainability in the study plan carried out by the participants is scarce, since the subjects seen are not linked to the referred topics. In fact, a transversal methodology is not applied to develop the environment, society and economy dimensions, although in the educational model of the Autonomous University of Guerrero in force (2013), social responsibility, sustainable development and the principles are established as principles training.

In order to promote environmental issues, it is necessary for the institution and the professors to promote non-formal environmental education courses, workshops or programs for

students to develop skills and acquire lessons in this area. Likewise, the environmental dimension can be integrated into the formal curriculum as a cross-cutting theme for students to consolidate their environmental competencies.

The results found in this phase coincide with an investigation carried out by Aparicio, Rodríguez and Beltrán (2014), who explain that environmental issues have not been mainstreamed in the undergraduate and postgraduate study plans of the Autonomous University of Guerrero. Another study that coincides with this work is the one developed by Carrasco and Vásquez (2016); These authors show that the training in environmental education of students of the Bachelor of Education Sciences of the Autonomous University of Tlaxcala is scarce, which would prevent them from contributing to the understanding and solution of the environmental problem.

According to the above, it can be said that the lack of mainstreaming of curricula in universities justifies why students do not acquire skills, abilities, attitudes and values to act from their respective professional fields in the face of the environmental crisis. In relation to the latter, it should be taken into account that, if the curriculum does not include environmental education as a subject, non-formal projects can be proposed. Authors such as Yanez and Álvarez (2019) consider that in the countries the teaching of Environmental Education should be included in a cross-curricular way through their educational systems, Linares, Tovilla and De la Preza also consider that Environmental Education is necessary to help raise awareness about the problem affecting mangroves today. They also establish that through workshops for the protection of mangroves, some people have been involved in the rational use of resources.

Pedagogical-didactic design of the course-workshop: implementation and evaluation

The course-workshop implemented had theoretical, methodological and didactic foundations adjusted to different educational theories, among which the contributions of Nieto-Caraveo (2001), Tobón et al. (2010), Cuevas et al. (2011), Serrano and Pons (2011) and Ruiz (s. F).

As already mentioned, this course-workshop was applied with the method of non-formal education; This means that although it does not appear in the mainstreaming of the formal curriculum, it was applied in order to promote environmental competencies in university students, and the results were satisfactory, since students were aware of the importance that lies in the conservation of mangroves.

As for similar studies that aimed at the protection of mangroves, mention may be made of Forero and Mahecha (2006), who conducted an investigation in San Andres Island (Colombia). In this work the participating children developed knowledge about the species and its habitats, and showed notable attitudinal and participatory changes.

On the other hand, Linares et al. (2004) carried out a project to try to raise awareness among the children of the Federal Primary School Juan Escutia, Mapstepec, Chiapas (Mexico) about the ecological and economic importance of the care and preservation of mangrove resources for the benefit of the communities. The activities proposed in this work were supported by exhibitions with videos, games and other school activities. The conclusions of this work demonstrate that environmental education initiatives provide results that benefit natural resources and, consequently, people themselves. Likewise, Yanez and Álvarez (2019b) affirm that different countries must incorporate the principle of curricular mainstreaming in the teaching of Environmental Education for sustainable development through their educational systems. The provisions stipulated above are due to the fact that in the curricula of all educational levels, importance should be given to Education for Sustainable Development because of the importance it represents.

Conclusions

The present research fulfilled its purposes, that is, the principles of the educational model of the UAGro were met, since the issue of sustainability was taken as a guiding principle to address the environmental problem. In fact, by detecting that there was a small environmental dimension in the curriculum where this work was carried out, a non-formal environmental education program was contributed to address the issue of mangrove conservation. In this way it was sought that students acquire sustainable learning and skills not only to conserve mangroves, but also to face the environmental crisis, specifically in the state of Guerrero.

To develop this type of environmental education programs, of course, you must first choose the appropriate teaching and pedagogical methodology and then carry out a design that fits the context where you plan to apply.

Finally, it can be noted that the results of the diagnosis developed showed the need to include the environmental dimension in the formal curriculum, as well as non-formal teaching methods to protect natural resources. The university, therefore, must incorporate environmental education as a non-formal cross-cutting theme in its curricula, so that students promote

environmental competencies to face current environmental problems with proposals for solutions. In short, you cannot neglect the benefits that mangroves offer for the environment and for the social.

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Software	Adriana Miranda Esteban «principal» Ramón Bedolla Solano «iguall» Juan José Bedolla Solano «igual»
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