MENDIVE
REVISTA DE EDUCACIÓN

Original article

Methodology for the treatment of content on climate change in the Physics discipline

Metodología para el tratamiento al contenido sobre cambio climático en la disciplina Física

Metodologia para o tratamento de conteúdos sobre mudanças climáticas na disciplina de Física

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Received: March 20, 2022.
Accepted: September 1, 2022.

ABSTRACT
Raising the perception of risk, increasing the level of knowledge and the degree of participation of the university community in confronting climate change is a priority for the Cuban University. The objective of the research was to present a methodology for the treatment of the content on climate change in the Physics discipline in the Agronomy career that is characterized by being systemic, integrating, flexible, developing and generalizing that allows integrating the contents of the discipline the bases of climate change in the teaching-learning process. The methods used were the following: criticism and source analysis, critical opinion and collective construction workshop, observation, documentary review and interview. The article refers to the stages in which the methodology is structured and the procedures that teachers must undertake to treat the contents on climate change and the appropriation by students of an environmental culture. It is concluded that the methodology has demonstrated its effectiveness in practice, while transformations are observed in the way of acting of those involved to face and mitigate the effects of climate change. The research is part of the project Training of the University Professional for the Management of Local and Sustainable Development of the Las Tunas territory attached to the Faculty of Economic Sciences of the University of Las Tunas.

Keywords: climate change; contents; environmental culture; physical discipline; teaching-learning process.

RESUMEN
Elevar la percepción del riesgo, aumentar el nivel de conocimiento y el grado de participación de la comunidad universitaria en el enfrentamiento al cambio climático es una prioridad para la Universidad cubana. La investigación tuvo como objetivo presentar una metodología para el

tratamiento al contenido sobre cambio climático en la disciplina Física en la carrera de Agronomía que se caracteriza por ser sistémica, integradora, flexible, desarrolladora y generalizadora que permite integrar a los contenidos de la disciplina las bases físicas del cambio climático en el proceso de enseñanza aprendizaje. Los métodos que se emplearon fueron los siguientes: crítica y análisis de fuente, el taller de opinión crítica y construcción colectiva, la observación, la revisión documental y la entrevista. En el artículo se refiere a las etapas en que está estructurada la metodología y los procedimientos que deben acometer los profesores para dar tratamiento a los contenidos sobre cambio climático y a la apropiación por los estudiantes de una cultura medioambiental. Se concluye que la metodología ha demostrado su efectividad en la práctica, en tanto se observan transformaciones en el modo de actuación de los implicados para enfrentar y mitigar los efectos del cambio climático. La investigación forma parte del proyecto Formación del Profesional Universitario para la Gestión del Desarrollo Local y Sostenible del territorio tunero adscripto a la Facultad de Ciencias Económicas de la Universidad de Las Tunas.

Palabras claves: cambio climático; contenido; cultura medioambiental; disciplina Física; proceso de enseñanza aprendizaje.

RESUMO
Aumentar a percepção de risco, aumentar o nível de conhecimento e o grau de participação da comunidade universitária no enfrentamento das mudanças climáticas é uma prioridade para a Universidade cubana. O objetivo da pesquisa foi apresentar uma metodologia para o tratamento do conteúdo sobre mudanças climáticas na disciplina de Física na carreira de Agronomia que se caracteriza por ser sistêmica, integradora, flexível, desenvolvendo e generalizando que permite integrar os conteúdos da disciplina a as bases das mudanças climáticas no processo de ensino-aprendizagem. Os métodos utilizados foram: crítica e análise de fontes, oficina de opinião crítica e construção coletiva, observação, revisão documental e entrevista. O artigo refere-se às etapas em que se estruturam a metodologia e os procedimentos que os professores devem empreender para tratar os conteúdos sobre mudanças climáticas e a apropriação pelos alunos de uma cultura ambiental. Conclui-se que a metodologia tem demonstrado sua eficácia na prática, ao mesmo tempo em que se observam transformações na forma de atuação dos envolvidos para enfrentar e mitigar os efeitos das mudanças climáticas. A pesquisa faz parte do projeto Formação do Profissional Universitário para a Gestão do Desenvolvimento Local e Sustentável do Território de Las Tunas vinculado à Faculdade de Ciências Econômicas da Universidade de Las Tunas.

Palavras-chave: mudança climática; conteúdo; cultura meio-ambiental; disciplina Física; processo de ensino aprendizagem.

INTRODUCTION

Society entrusts the education system with the training of new generations according to their interests. This implies the appropriation by each man of the cultural heritage that preceded him so that he can act, understand, explain and transform, in the concrete historical conditions, the world without putting future generations at risk.

Irrational consumption habits and lifestyle, characteristic of a linear economy, have caused climate change to constitute one of the most serious environmental problems facing humanity. Its consequences impact

the entire climate system: the atmosphere; the hydrosphere; the cryosphere; the geosphere; and the biosphere; as well as in their interactions (Kalmus, 2018).

In Cuba it is a priority that the university student, in general and those of the agronomic sciences in particular, assimilate a comprehensive and contextualized culture that summarizes the knowledge, skills and values necessary to establish adequate relationships with the environment (Alarcón, 2016).

In turn, the National Environmental Strategy 2016/2020 establishes as a principle and objective for educational systems:

> Increase the comprehensive environmental culture of the population, based on the development of knowledge, skills, attitudes, changes in behavior and modes of action that allow human beings to improve their relationship with the environment and contribute to the construction of a sustainable society. (CITMA, 2016, p.39)

For Blanco (2001), the general objective of Education is specified in the process of socialization of the individual, given in the assimilation by the subject of the socially valid content and its objectification, denoted in forms of conduct admissible by society.

The foregoing implies a sustainable use of its natural resources and adopt decisions to mitigate and adapt to climate change; This leads to: raising awareness about the role of man in climate change, modifying the way people think and act, preparing decision makers and executors of policies; carry out studies on the impact of extreme events and climate change; which shows the need to strengthen the environmental training on climate change of those involved in the productive and social processes that are developed in the country.

Therefore, the professional model for the Agronomy career admits as a general objective:

> Efficiently manage the productive processes in the agricultural production systems (...) assuming an attitude in accordance with the ethics of the profession and with solid aesthetic, moral, humanistic, solidarity, honesty and responsibility principles; typical of a revolutionary professional, committed to socialism and the country whose purpose is the stable increase of food and raw materials of plant and animal origin required by society, with minimal damage to the environment. (Ministry of Higher Education [MES], 2017, pp 8-9)

In this case, it is unavoidable to prepare future professionals for efficient management in the processes that take place in agricultural production systems, for which it is necessary to search for methodologies and strategies that favor the application of actions that contribute to the planning, implementation, control, updating and contextualization of content on climate change

In the training of the agricultural engineer, the Physics discipline (FD) contributes, by dealing with the basic laws and principles of nature, to foster an environmental culture in the student, while it is in charge of:

> Explain with adequate environmental, energy and economic analysis, and applying physical knowledge,

> the negative effects caused by human activity on the environment and the feasibility of the tasks and projects that it undertakes both in the scientific sphere and in the defense of the country. (MES, 2017, p.118)

Correspondingly, this implies new challenges for teachers of this discipline, responsible for guiding the content system towards the sustainable development of society.

However, as a result of the factual diagnosis and given the experience of the authors, it was possible to verify that in the teaching-learning process of the Physical discipline (hereinafter, PEA of the DF), the following manifestations are appreciated:

- Insufficiencies in the identification of the problems generated by climate change at the local or territorial level, as well as the factors and physical phenomena that affect agricultural production systems by students and teachers.
- Students assume condescending or evasive behaviors in the face of manifestations generated by climate change.
- In teachers to link the causes and consequences of climate change with the contents of the Physical discipline.

Based on these elements, the manifest contradiction between social demands, aimed at producing food to meet the growing demands of society with minimal damage to the environment, and the insufficiencies of the teaching-learning process in the physical discipline, is identified.

From the Federal District, the IPCC report (2021), is pre-eminent, as it reveals the physical foundations of climate change; Ten et al. (2013) exposes a didactic for climate change, with emphasis on research and experiment. Amado et al. (2019) and Zaldivar et al. (2019) address environmental education the first author in the initial training of Mathematics-Physics teachers; the second in the Bachelor of Education career. Physics, towards the protection of the environment. In various universities around the world, the subject (discipline) Environmental Physics is taught, most of which focus on the different components of the climate system: the atmosphere; the oceans; the lithosphere and the energetic relationships between them.

From the above, it can be concluded that, in the PEA of the DF in the Agronomy career, there are difficulties in the selection, sequencing and transposition of content that constitute the physical bases of climate change, which limits the development of an environmental culture and in consequently the integral formation of the students.

The objective of the research was to present a methodology for the treatment of the content on climate change in the Physics discipline in the Agronomy career that is characterized by being systemic, integrating, flexible, developing and generalizing; organized in stages with their respective procedures which makes it possible to select, organize and transpose the physical contents that constitute the basis of climate change that affects agricultural production systems.

MATERIALS AND METHODS

The methods used were the following: criticism and source analysis, critical opinion and collective construction workshop, observation, documentary review and interview.

The source criticism and analysis were based on the procedures of induction-deduction and analysis-synthesis of the theoretical order; It was used to carry out the

theoretical study on the characteristics of the methodology as a result of an investigation both theoretically and practically and to determine, in correspondence, the structure of the proposed methodology.

The interview was conducted with nine Physics professors at the University of Las Tunas to obtain information on the level of environmental culture that students show in Physics classes and the knowledge that professors have about climate change, its causes and consequences, since In accordance with this, what treatment do they carry out with the content (selection, sequencing and transposition) on climate change in the teaching of the Physics discipline.

Observation to assess the behavior of students in the different spaces of the university community and its impact on aggravating, mitigating and adapting to climate change.

The documentary review to evaluate the orientation for the treatment of environmental problems, with emphasis on those derived and aggravated by climate change in the "E" study plan of the Agronomy major; the inclusion of problems related to climate change in the text planned for the career and the potential offered by the physical contents to favor the formation of an environmental culture in the students of the Agronomy career that allow them to mitigate and adapt to climate change.

The critical opinion and collective construction workshops were used to seek consensus on the feasibility of the proposed methodology for the treatment of content on climate change in the DF in the relevant groups that were submitted for discussion.

RESULTS

Methodology for the treatment of the content on climate change in the Physics discipline in the Agronomy career

Education is a historically conditioned phenomenon; while culture is an essential source to determine the educational content that is transmitted to new generations and contributes to personal and social training and development.

We must mean that the cultural practice, the values and the vision of the world assumed by man in relation to nature is at the base of the current climate change; It is the consequence of an irrational lifestyle sustained by excessive consumption that systematically pollutes with waste returned to the environment.

In the context of this research, the methodology is based on the method, which presupposes the procedures and techniques of teachers and students to achieve the proposed objective. The method adjusts to the logic of the content and the characteristics of the students, which contributes to the integral formation of the student. In the method, there is a dialectical interaction between the teacher-student relationship and the procedures to activate essential logical thinking in the PEA of FD.

The methodology is structured in: general objective, foundation, stages and procedures. It is proposed as a general objective of the methodology to elaborate the procedures that allow the appropriation of the agrophysical contents from the potentialities of the content system through the PEA of the FD.

The proposed methodology starts from the insufficiencies in the environmental culture in the students; it is based on dialectical materialism, a philosophical foundation that supports the material unity of the world and

the causal relationship between natural phenomena; in the historical-cultural approach: development precedes learning, the active and independent character of the student in the appropriation of the content, mediated by relationships with other students and the teacher; and from the didactic based on problematic teaching and its methods that favor a developer, contextualized and interdisciplinary PEA directed towards the integral formation of the student.

In turn, the conceptual apparatus of the methodology that is presented is supported by the didactic model of treatment of the content on climate change in the Physical discipline in the Agronomy career and in the relationships that exist between the subsystem's contextualization and selection of the agrophysical content.

The proposed methodology has the following characteristics:

- Systemic: it favors that each stage reinforces the presence of the other, it constitutes an elaboration that is based on the proposed didactic model, for the treatment of the content on climate change, which requires a relationship between the selection of the agrophysical contents and their contextualization in the SPA affected by climate change.
- Integrative: enables the integration of the agrophysical content system concepts, skills, procedures, and value formation with the FD content system through the identification and solution of agrophysical problems to contribute to the student's environmental culture.
- Flexible: it allows the adaptation of the methodology in correspondence with the needs and perspectives that teachers may have in accordance with the logic of the content and the PEA in their professional performance.
- Developer: facilitates the student to become actively and consciously involved in the PEA, in exchange with their classmates and with the teacher who, in accordance with the diversity of the students, supports and organizes learning for the development of an environmental culture and its integral formation.
- Generalizing: allows students to arrive at generalizations about natural processes and phenomena, with emphasis on those related to climate change that enable them to appropriate essences and seek solutions based on nature.

Next, the way in which the methodology is organized for the treatment of the content on climate change in the Physics discipline in the Agronomy career, which is developed from three stages with their corresponding procedures and actions.

The procedures that are proposed are directed towards the external and internal aspects of the PEA to promote the development of logical thinking, the formation of feelings, attitudes and values that provoke the integral formation of the student. Next, each of the stages is explained with its procedures:

First stage: Determination of agrophysical problems.

Objective: To identify the problems aggravated or derived from climate change present in the SPA and, based on problematic teaching, to present situations to the students in which contradictions are revealed and solve them independently under the guidance of the teacher that allow mitigating and adapting to the effects of climate change.

Procedure I: Identify agrophysical problems in agricultural production systems.

We proceed to characterize the agricultural production systems to determine the main problems present in the physical factors of the environment, and then determine those that are aggravated or derived from climate change. To do this:

- Search, study and summarize the statistical yearbook of the province of Las Tunas and of each municipality; the Environmental Panorama of Cuba 2020 among others located on the site of the National Office of Statistics and Information.

This allows to have a characterization of the territory: the population; the weather; renewable energy: devices and substitution; agricultural entities; genetic and agro-productive classification of soils; environmental investments; total and cultivated area; main crops, the production obtained and its yield, among others.

- Determine the main problems present in the physical factors of the environment in agricultural production systems.

Las Tunas province has an area of 942.3 km^2, eminently flat. Its population is concentrated in the urban sector, only 32.8% of its total is located in the rural sector. Only 19.3% of its surface is covered with forests.

In the territory of Las Tunas there are 270 cooperatives belonging to the agricultural and sugar industry sectors, which constitute the agricultural production systems, most likely where the future Agricultural Engineers will be located.

The main climate indicators are the following: rainfall has reached an annual average of 965 mm over the last 32 years, which is classified as moderately rainy with a slight upward trend, especially in the 2005-2020 interval. The average number of rainy days amounts to 157.

In the 2005-2020 interval, the maximum average temperature is 31.2ºC and the minimum average takes a value of 21.8ºC. The prevailing winds are from the east-northeast (ENE) with a speed of 14.9 km/h and the average cloud cover is 4 eighths with a relative humidity of 77.0%. In summary, it is a very warm climate, with moderate rain, mostly clear skies with winds coming from the east northeast.

In the Earth's atmosphere, for the analysis of the meteorological phenomena that determine the climate and impact its transformation, the most essential layer is the one in contact with the surface, the troposphere, as it contains the air we breathe and its thickness fluctuates between six and 20 km. Even though there are no monitoring stations in the province of Las Tunas, the one carried out at the country level shows low levels of greenhouse gases in the troposphere.

However, in the case of Methane (CH_4 and nitrogen dioxide (NO_2), agriculture, forestry and other land uses are responsible for 57.9% and 87.4% of their emissions, respectively. However, in relation to the emission of carbon dioxide (CO_2), these activities act as a sink for 37.0% of CO_2, while 90.7% of its emission falls directly on the 90.7% of energy-related activity.

Water is scarce due to the characteristics of the province: rivers of short length and low flow, with few reservoirs, which is why there is not enough water to supply crops and human needs. This implies that a good part of agriculture is obtained from the rain, which has an average pH of 7.2 and is characterized by being developed in dry land and dependent on the incidence of meteorological phenomena that affect the climate.

The genetic classification of the soils shows that 67.6% are: fersialitic, brown and vertisols hydromorphic. According to their

productivity, 63.3% of the total are classified as moderately and little productive; the latter represents 44.0%. The main edaphic limiting factors present are: increased salinity, low content of organic matter and moisture retention.

Of the total investment expenditure for environmental protection, 5.2% refers to the economic activity of agriculture, livestock, forestry and fishing, and 12.3% to the sugar industry. By environmental sectors, 85.0% is concentrated in water and is usually centralized in the municipality of Las Tunas.

- To identify the agrophysical problems.

From the characterization carried out previously, it can be inferred that the main environmental problems that affect the province of Las Tunas are: soil degradation; effects on forest cover; pollution; loss of biological diversity and deterioration of ecosystems; shortage and difficulties with the management, availability and quality of water; impacts of climate change; among other.

The changes that are manifested in the climate of the territory of Las Tunas are: the increase in temperature, changes in the rainfall regime, the rise in the mean level of the sea and the increase in the frequency and extension of droughts, among other effects. Its identification, analysis, assessment and impact from the environmental, social and economic dimensions through the physical contents is an insufficiency, even present in the PEA of the DF.

The action of man is recognized as the cause of climate change observed today, from the use of fossil fuels as the main source of the energy matrix and emitter of greenhouse gases. Agricultural activity worldwide is responsible for 25.0% of them.

Second stage: Implementation of the agrophysical content in the Physics discipline.

Objective: Organize by the teacher the agrophysical contents to be inserted in the content system of the DF to treat the problems aggravated or derived from climate change and promote environmental culture in students. This stage allows selection and sequencing. This stage allows selecting, organizing and transposing the agrophysical content that supports the agrophysical problems identified in the previous stage and integrating it into FD without the need to increase content in the discipline's curriculum.

Procedure II: Selection, sequencing and transposition of the agrophysical content.

We proceed to the analysis of the contents that constitute the basis of climate change, its selection is in correspondence with the physical sciences, which allows its insertion in the content system in the Physics discipline in the Agronomy career. In essence, it is about determining the agrophysical contents that allow to relate to the problems present in the SPA and its subsequent sequencing.

For this, the teacher:

- Search, study and summarize the reports of the Intergovernmental Panel on Climate Change (IPCC).
- Determine from the physical bases of climate change, what content is necessary for the student to assimilate to adapt and mitigate the problems present in the SPA, that is, agrophysical content.
- Didactic transposition of these contents for their insertion in the content system in the Physics discipline in the Agronomy career.

- Sequencing of the agrophysical contents in the program of the Physics discipline.

Adopt decisions to define the agrophysical contents, part of determining pedagogical criteria that facilitate their selection, among them:

- The training nature: enables the comprehensive training of a professional with a broad profile and, consequently, endows him with a solid environmental culture.
- Interdisciplinarity: the problems aggravated or derived from climate change are complex, their understanding, confrontation and solution demand the relationship between various disciplines.
- Contextualization: climate change is multi-scalar, it occurs at the global, regional and local levels; it is in the local SPAs where their greatest impact is outlined.
- Essentiality: that knowledge on climate change that from the knowledge systems of the DF can be treated to contribute to their basic training in the different spheres of action.
- The problems: environmental, social, economic and energy, with emphasis present in the SPA, whose identification and solution favor developer learning.
- The significance: contents of a high degree of transcendence for understanding the impact of climate change on SPAs that enable the lasting assimilation of knowledge and the development of skills, attitudes and values in students.

As a result, the selected contents on climate change to be treated in the FD of the Agronomy career are:

I. Factual: global temperature rise (atmosphere, land surface, and oceans); warming of the sea; rising ocean levels; decrease in snow and ice layers extreme weather events (heat and cold waves, frequent hurricanes or high intensity typhoons); variability in rainfall, droughts; alteration of the thermal structure and water quality of rivers; changes in terrestrial, marine and freshwater, agricultural and forest biological systems and in social systems.

II. Concepts: time; weather, climate system; climatic variability; climate change; ecological footprint; atmospheric composition; greenhouse effect; natural greenhouse effect; anthropogenic greenhouse effect; greenhouse gases; water steam; aerosol sprays; albedo, water vapor; evo perspiration; hydrological cycle; loss of habitat; carbon sink; renewable and non-renewable energies; energy density; energy return rate; solar radiation; albedo effect; food safety; sustainable development; innovation and technological change.

III. Relational: principle of thermodynamics and law of energy conservation that govern the energy flow in the SPA and in the radiation of the sun-atmosphere-earth; Wien 's law in the emission of radiation from the sun to the earth; Newton's laws in operation of agricultural machinery and its impact on SPAs; the kinetic molecular theory of fluids and electromagnetic behavior of light; between climate change and SPA components; between the components that constitute the biosphere and between the components of the climate system.

The agrophysical contents as instruments to achieve the objectives proposed in the FD, will not depend only on their adequate selection, but also on their sequencing that facilitates learning. The one proposed by the FD program is maintained, in accordance with the historical evolution of the discipline and its logic: the study of facts and

phenomena, then they are modeled, this allows establishing hypotheses and from these derive principles, laws and theories, which once applied they allow arriving at new facts.

The Physics that explains the causes and consequences of climate change, especially its impact on SPAs, is complex; therefore, after establishing the selection criteria and ensuring an adequate logical and pedagogical sequence, it is necessary to transform this scientific knowledge on climate change into agrophysical teaching content, with an environmental perspective, that is, to transpose the physical content that is at the base of climate change.

It is proposed that during the process of transforming scientific knowledge into teaching content, it be carried out taking into account the following requirements:

- Recognize the basic contents and the logic that govern the discipline from which the program is designed.
- Identify the contents with the greatest link to the basic training of the profession that foster interest and motivation for the discipline.
- Identify the contents that allow the development of a comprehensive training of the future professional.
- Design strategies to facilitate understanding and developer learning.

For the solution of agrophysical problems, it is necessary for students to master operations that allow them to make assumptions about the given physical situation, apply different physical principles and laws, and calculate the final result. The operations proposal is exemplified below:

Stage I: organization and interpretation of the problem situation.

- Read carefully the statement of the exercise several times and determine the lexical unknowns, and the initial conditions.
- Draw the physical situation expressed in the statement, if necessary, or complete the graphed situation.
- Extract the data given to you explicitly and implicitly and the unknowns algebraically.

II Stage: solution of the unknowns.

- Write the fundamental equations that relate to the situation described in the problem.
- Select and pose the equation that allows solving the unknown; clear if necessary; remember to work with the units of measure of each physical quantity in the SI.

III Stage: control and evaluation of the results.

- Rectify the truth of the equation from the work with the units of measure of each physical quantity.
- Check the particular values of the solution, compare the results with what you expected intuitively; Ask yourself, is the result logical?
- Analyze the impact of the technology or law of scientific knowledge, which correspond to the problem, on the development of society, the environment and the economy. how _ contributes to conception world scientist ? _

The selection, sequencing and transposition of agrophysical knowledge makes it possible to carry out assessments of the impact of climate change on local SPAs and consequently identify and solve problems present in them: soil degradation, increased temperatures, variability of precipitation, changes in water quality; saline intrusion; deforestation; loss of biodiversity and

changes in biological systems in social systems, among others.

In the dosage of the content of the FD, the topics and their corresponding class system are determined through which the agrophysical knowledge will be given out according to the problem and the objectives of the program; insisting on the identification and solution of agrophysical problems present in SPAs.

DISCUSSION

The proposed methodology adheres to the criteria given by De Armas et al. (sf, as cited in Alonso et al. (2019), which in the specific plane implies: "a system of methods, procedures and techniques that, regulated by certain requirements, allow us to better order our thinking and our way of acting to obtain certain cognitive purposes" (p. 17).

The foregoing allows, based on the characteristics of the methodology, to have a tool that facilitates the selection, sequencing and transposition of the content on climate change from the FD. This makes it easier to strengthen the comprehensive training of future agricultural engineers with an emphasis on an environmental culture that allows them to adapt and mitigate the effects of climate change.

The interview conducted with the Physics professors at the University of Las Tunas reveals that environmental culture in the students is low as it is shown in their ways of acting low responsibility with the care of the environment; low notion of recycling, saving and reusing; they assume consumption criteria typical of capitalist society and their knowledge of the problems arising from climate change on a local scale is insufficient.

It coincides with Francisco et al. (2021), that an environmental culture implies: preparing the student to develop their future professional work, solving professional problems without harming the environment and human health; make the student aware of the principles that support the protection of the environment and the rational use of natural resources, as well as working with spiritual and material values with respect to the environment.

The offered methodology exalts the axiological, as it allows to assume a meaning and meaning to the physical knowledge that is at the base of climate change; contributes to the formation, development and modification of environmental values, respect for nature, austerity in the use of natural resources, respect for different forms of life, and the human being in harmony with the environment without which it is impossible to mitigate and adapt to climate change.

That is why it agrees with the criterion of Licea (2006, as cited in Santa Cruz and Mesa, 2015) that the student in his process of acquiring environmental culture states:

- Knowledge about the environment concept and its components; the requirements of sustainable development and global, national and local environmental problems.
- Identification of positive and negative human influences on the global, national and local environment and their causes in the environmental problems and impacts they generate.
- Investigation of alternatives for the solution of environmental problems at a local scale.
- Responsible action in the environment: student, productive-labor, family, and recreational.
- Defense of convictions that demonstrate commitment to current and future generations for the preservation and improvement of the environment.

- Expression of feelings and postures of disagreement with irresponsible behavior towards the environment.

The interview with the teachers reveals that when defining climate change, 64.0% focus on the consequences, or the causes that originate it, and the environmental problems they identify remain on a global or country scale and not on a local level.

100% agree that the basic text has very little connection with environmental problems, especially with climate change, despite its excellent academic level and the logic of the discipline. The DF program in the Agronomy career is organized from the logic of science, but with poor relationship with the problems of the profession

From the documentary review of the basic text of the FD, it was concluded that it is based on teaching based on problem solving, structured in: solved examples with an approach based on four steps: identify, propose, execute and evaluate; questions at the end of the chapter to reaffirm the understanding of the concepts and exercises that are problems organized by levels of assimilation.

Of the 2,775 problems and questions reviewed, which correspond to the knowledge systems determined in the DF program, only 60, which represents 2.2%, are related to the most frequent and general problems of the Agronomy career.

Of the 60 that are related to the Agronomy career, 37 are linked to situations related to agricultural machinery; 16 with the weather system; 11 with the atmosphere; three with the hydrosphere among others. Only two of them directly with climate change.

The foregoing expresses the disciplinary nature of the same as it is essentially related to the Mathematical discipline. Its contextualization is adjusted to the development of the science in question and the technological advances of the first decade of the 21st century: Astronomy, the automobile industry and household appliances.

The critical opinion and collective construction workshops allowed socializing the Methodology for the treatment of the content on climate change in the Physics discipline in the Agronomy career, from which recommendations were issued for its improvement; between them:

- Perfect the characterization of the physical environment in order to expose its relationship with the social, economic and energy dimensions.
- Delve into the agrophysical problems present in agricultural production systems that later become cognitive nodes for the establishment of learning networks between the different subjects of the academic year.
- Argue the relationship between the agrophysical contents and the methods to be used in the PEA of the DF to contribute to the formation of an environmental culture.

The characterization of the physical factors that make up the agricultural production systems of the province is consistent with what is published in the environmental series of the province (ONEI, 2018). The characterization reflects the main problems aggravated or generated by climate change present in the local agricultural production systems where the students are inserted.

The analysis of the current situation reveals insufficient mastery of the contents on climate change in the students, which demonstrate the inconsistencies in the conception and execution of the treatment process for these in the identification and resolution of problems.

The methodology for the treatment of the content on climate change in the Physics discipline in the Agronomy career constitutes the instrument that allows the realization of the elaborated didactic model; part of the general objective, and is structured in three stages with their procedures and respective actions to corroborate in practice the treatment of the content on climate change in the teaching of the Physical discipline by teachers and the learning of knowledge, the development of skills and values and attitudes in students that allow them to appropriate an environmental culture that enables them to adapt and mitigate the effects of climate change on agricultural production systems.

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Conflict of interests:

The authors declare not to have any interest conflicts.

Authors contribution:

The authors have participated in the design and writing of the work, and analysis of the documents.