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Historical trends in the treatment of biodiversity content in the Cuban Middle School: a necessary review

Tendencias históricas del tratamiento al contenido biodiversidad en la Secundaria Básica cubana: una revisión necesaria

Tendências históricas no tratamento do conteúdo de biodiversidade no Ensino Médio Cubano: uma revisão necessária

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ABSTRACT
The article that is presented aims to base the results of a historical analysis of the treatment of biodiversity content, which allows revealing the main characteristics and most significant trends that have been progressively generating this content in the context of the Basic Secondary education level of Cuba. The research was based on the materialist dialectical paradigm and on a descriptive-explanatory methodology that allowed reviewing the consulted bibliography, based on the use of theoretical methods such as historical-logical, analytical-synthetic, inductive-deductive, as well as the empirical level documentary analysis. The results show how the variants used for the study of biodiversity evolved over time from the biological contents, the methodological proposals during the teaching activity, the didactic resources that were used to support the treatment and the environmental approach that was given to the content. Essentially, the historical study constitutes an antecedent that reveals the progressive transformation of the treatment of biodiversity content from a descontextualized learning of the environmental reality, with a high level of information and specialization, until reaching one that is closer to the school and community environment starting from the use of methods and procedures with an investigative approach.

Keywords: Biodiversity; Biology; Didac tics; Learning; Teaching.

RESUMEN
El artículo que se presenta tiene como objetivo fundamentar los resultados de un análisis histórico del tratamiento al contenido de biodiversidad, que permita revelar las principales características y tendencias más significativas qué ha venido generando de forma progresiva este contenido en el contexto del nivel educativo Secundaria Básica en Cuba. La investigación se sustentó en el paradigma dialéctico materialista y en una metodología descriptiva-explicativa que permitió revisar la bibliografía consultada, a partir de la utilización de métodos teóricos como el histórico-lógico, analítico-sintético, inductivo-deductivo, así como del nivel empírico el análisis documental. Los resultados demuestran cómo evolucionaron en el tiempo las variantes utilizadas para el estudio de la biodiversidad desde los contenidos biológicos, las propuestas metodológicas durante la actividad

docente, los recursos didácticos que se utilizaron para apoyar el tratamiento y el enfoque ambiental que se le dio al contenido. Esencialmente, el estudio histórico constituye un antecedente que revela la transformación progresiva del tratamiento al contenido de biodiversidad desde un aprendizaje descontextualizado de la realidad ambiental, con un nivel alto de información y especialización, hasta llegar a uno más cercano con el entorno educativo y comunitario a partir del empleo de métodos y procedimientos con un enfoque investigativo.

Palabras clave: Aprendizaje; Biodiversidad; Biología, Didáctica; Enseñanza.

RESUMO
O artigo que se apresenta pretende fundamentar os resultados de uma análise histórica do tratamento dos conteúdos da biodiversidade, que permite revelar as principais características e tendências mais significativas que vão gerando progressivamente esses conteúdos no contexto do ensino médio básico de Cuba. A pesquisa baseou-se no paradigma dialético materialista e numa metodologia descritivo-explicativa que permitiu a revisão da bibliografia consultada, a partir da utilização de métodos teóricos como histórico-lógico, analítico-sintético, indutivo-dedutivo, bem como o nível empírico. Análise documental. Os resultados mostram como as variantes utilizadas para o estudo da biodiversidade evoluíram ao longo do tempo a partir dos conteúdos biológicos, das propostas metodológicas durante a atividade docente, dos recursos didáticos que serviram de apoio ao tratamento e da abordagem ambiental que foi dada aos conteúdos. Essencialmente, o estudo histórico constitui um antecedente que revela a transformação progressiva do tratamento dos conteúdos da biodiversidade a partir de uma aprendizagem descontextualizada da realidade ambiental, com alto nível de informação e especialização, até chegar a um mais próximo do ambiente escolar e comunitário partindo da utilização de métodos e procedimentos com abordagem investigativa.

Palavras-chave: Aprendisajem; Biodiversidade; Biologia; Didática; Ensino.

INTRODUCTION

In Cuba, the basic secondary education level is aimed at the basic comprehensive training of the new generations on the basis of a scientific conception of the world in the students; in achieving this aspiration plays an important role biology, which aims to study biodiversity and enables the co nstruction of new knowledge that is a column that connects various themes and frames that are invisible to the treated in a fragmented way (Castro & Valbuena, 2007).

In this sense, in recent years at international level have carried out numerous research focused on the scientific content and teaching biodiversity, being particularly interesting for our studies those who analyze the teaching and learning of biodiversity in school textbooks and other normative documents at different educational levels. These includ e García & Martínez, (2010), Bermúdez (2018), Van Weelie & Boersma (2018), Martínez, García & García, (2019), Santosz - Ellakuria (2019), Herrera (2020), among others.

In Cuba there is a history of research that has made important contributions to the improvement of the teaching of Biology at the Basic Secondary educational

level. Among those: Hernández, Pérez- Puelles, Campuzano, Díaz, Santos, Fumero, (1989), Hernández, Díaz, Campuzano, & Fumero (1990), Sal cedo, Hernández, del Llano, Mc Pherson & Daudinot (2002), Rodrígu ez, Pedro, Esther, Bacardí, Fernández, Santos, Matos, Carvajal, & Berta (2012), García & Méndez (2017), Chacón, Medina, Milian , Blanco, Jardinot, Juanes, Luis, Castro, Castillo & Roberto (2019), Chacón, Medina, Jardinot, Milián, Juanes & Castillo, (2019), García, Sánchez & Garc ía (2020), among others.

Consequently, these Cuban authors constitute the antecedents that demonstrate the dominance they had and the level reached by the environmental sciences in their time and the prevailing trends in them, which demonstrates the efforts to find the best educational strategies to improve the content of biodiversity within the framework of the teaching-learning process of Biology at the Basic Secondary educational level.

Therefore, this results a conducive moment to reflect about the historic evolution of the treatment to the content of biodiversity in the Basic Secondary education, which has reached the contemporaneous epoch, particular relevance in an environmental context that has consolidated and widespread the scientific field, hence, it is impossible that the Cuban middle school does not incorporate the treatment of the concept of biodiversity in the teaching-learning process of Biology, to contribute in educating the formation of the scientific conception of the world as the demands posed by the Cuban society and the existing environmental problems.

From this perspective, the objective of this study is to base the results of a historical analysis of the treatment of biodiversity content, which allows revealing the main characteristics and most significant trends that have progressively generated this content in the context of Basic Secondary educational level. .

The achievement of this purpose is linked to the following question:

1. How has the treatment of biodiversity content changed over time?

In this way, to carry out the research, a descriptive-explanatory methodology was used and the dialectical materialist paradigm was assumed, which is characterized by fostering a process of historical analysis of social phenomena and an indissoluble relationship between theory-praxis. (Gil, León & Morales, 2017).

The study used methods of the theoretical level such as the historical-logical, analytical-synthetic, the inductive deductive and the system approach, which provided the necessary elements for the analysis of the object of the research and which also contributed to characterize the stages of the historical development, defining trends, systemati zing information on the subject and determining the referential and conceptual framework, and interpreting and analyzing the information obtained.

Among the empirical prevailed documentary analys is that allowed the evaluation of the programs of the subjects , methodological guidelines and textbooks for the subjects of seventh and eighth grade Biology, the normative documents of methodological work , ministerial resolutions and and environmental strategies , and the consultation of teachers, managers and methodologists of Biology of the referred educational level.

DEVELOPMENT

Given the importance of the content of biodiversity in the education Basic Secondary as a framework of this research, here we present the criteria and their respective indicators, as elements that we believe are fundamental in shaping the arguments to characterize the historical evolution of the treatment to the content of biodiversity.

Criterion A). The conception of environmental training of teachers.

The indicators of this criterion are:

1. Main events and normative documents developed in the international and national context in defense of the environment and the consolidation of environmental education.

Criterion B) The improvement of the didactics of biodiversity.

The indicators of this criterion are:

2. Characteristics of the programs, methodological guidelines and textbooks and their approach in relation to the content of biodiversity.

3. The theoretical - practical conceptions of the treatment to the objectives, the content, the teaching and learning methods and the methodological procedures.

4. The use of the means of teaching and learning.

5. The contextualized learning of biodiversity.

Once the selection criteria and indicators had been established, a search for references was carried out in the bibliographic databases in the first fortnight of December of the year 2019 on internet sites with electronic databases Web of Science (WOS), Scopus, SciELO. Key words used to search in databases were biodiversity, biodiversity content and teaching and learning of the biodiversity, biodiversity treatment of content and English analogues.

It was also reviewed the contents of the textbooks, programs and Biology methodological guidelines seventh and eighth grades of the Basic Secondary education to see what is included on the treatment of the content of biodiversity: First, if the term biodiversity appears, and, how the contents are organized, the treatment to the importance and how it is addressed the biodiversity loss and its consequences, and the problematic about the conservation for the education.

From the evaluations expressed, the research process emerged and it took into account some facts that marked milestones in the teaching of Biology in Cuba:

1. Classification of biological concepts with the implementation of the Theoretical Model of the Biology Discipline in General Polytechnic and Labor Education as part of the improvement plan of the National Education System in Cuba.

2. Establishment of improvement plans for the National Education System and its influence on the teaching of Biology.

3. Conception of the new model of Basic Secondary school, as part of the Third Educational Revolution.

From the theoretical systematization done by the author, there were settled, for historical analysis, the period between 1979 and 2021, based on the facts that marked milestones based on criteria and indicators exposed previously to reach identify and establish four stages whose limits were

established from the vigilance of each improvement:

Stage 1. (1979 -1999): Genesis of the organization and methodological structuring of the treatment of biodiversity content as part of the improvement of Biology.

Stage 2. (2000-2012): Treatment of biodiversity conten t in the framework of transformations in secondary education from the comprehensive general teacher.

Stage 3. (2013-2017): Treatment of biodiversity conten t aimed at disciplinary integration and sustainable development as part of improvement.

Stage 4. (2018 - 2021): The didactic-methodological update of the biodiversity content as part of the Third Perfection of the National Education System.

Next, a brief historical analysis of each of the established stages is carried out:

Step 1. (1975 -1999): Genesis organization and methodological structuring of the treatment to the content of biodiversity as part of the development of biology.

In 1975 the United Nations Educational Scientific and Cultural Organization (UNESCO), carried out in the world a diagnosis of resources, needs and priorities of the states in the field of environmental education. In Cuba, this situation facilitated the incorporation of environmental issues into the curriculum and the first attempts were made to link some subjects with environmental issues, through the Continuous Improvement Plan of the National Education System that began that year.

Later, in 1979, the Ministry of Education (Mined), assisted by the Cuban Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO), organized the First National Seminar on Environmental Education, referring to the environment with the participation of officials from the same and other organizations such as the Environment and Natural Resources Commission (COMARNA), the Cuban Commission of the UNESCO "Man and the Biosphere" Program (MAB), among others; This was a fundamental milestone in the recognition and realization of Environmental Education at the different educational levels.

Law 33 on -Protection of the environment and rational use of natural resources and January 1981 is promulgated and, in its Article 14 the introduction of the theoretical foundations on the protection of the environment in the National Education System is involved. In 1983 Circular 42 of the Ministry of Education was promulgated, which encourages the implementation of activities in schools, for the celebration of June 5 as World Environment Day, although this was at the morning level and general dissemination, an element that contributes to promoting the development of the environmental dimension and its contextualization and systematization at the Basic Secondary educational level.

In this period, environmental education and the treatment of biological content had a no systemic and traditional character, with a predominance of the teacher's transmitting activity and with an almost absolute divorce from the local and national environmental environment , so that the fundamental objective was the acquisition of reproductive knowledge on some of the environmental problems.

In 1986, the General Education curriculum was developed and included in the Theoretical Model of the Biology Discipline in General Polytechnic and Labor Education, which among its

objectives pursues the improvement of biological contents, with emphasis on the treatment of the environmental education. This document constituted a valuable foundation for the direction of the teaching-learning process of Biology in Cuba, by containing the selection of the contents, their didactic organization in the program and the improvement of the direction process for the assimilation of the teaching content, in particular what refers to the formation of a system of concepts and development of fundamental skills in the formation of the scientific conception of the world and its usefulness in practical and social life.

In this way, for all grades the validity of the guiding ideas that are in correspondence with the programming axes of biology formulated in 1987 is ratified, which are reflected in the Didactics of Biology book (Salcedo, Hernández, del Llano, Mc Pherson & Daudinot, 2002). These governing ideas reflect the generalizations that express the system of knowledge and working methods of biological sciences and form the basis for a conscious assimilation of knowledge.

Consequently, at this stage the V Environmental Education Seminar is being developed in the province of Camagüey in 1989, and it marks a new stage in the history of this process for all educational levels, including the Basic Secondary educational level. Based on this, in this education environmental issues are incorporated into programs, guidelines and textbooks. Hence, environmental education is limited to teaching work and the possibilities of extra- teaching and extracurricular activities are not sufficiently exploited. Subsequently, in 1990, the second improvement of the study plans and programs of the National System of Education took place, and with this the one of Basic Secondary, a stage that lasted until 2003.

In that order of ideas, the conception of the teaching of Biology constituted a requirement for the organization and methodological structuring of the biological content. Thus, the biological subjects are ordered as follows: Biology 1 (Seventh grade), Biology 2 (Eighth grade) and Biology 3 (Ninth grade), taking into account the classification system of living organisms in 5 kingdoms (Monera, Protista, Fungi, Plantae and Animalia), which caused changes in the organization of conceptual systems.

In this way, the programs were organized with a deductive approach to content; they began with generalizing units, in which the student appropriated the essential generalizations, and then operated with them in the following units, applying them to new situations in the study of groups of organisms. Thus, in the seventh grade Biology 1 textbook (1989) two generalizing units were conceived: "Diversity and unity of the living world" and "Introduction to the study of the evolution of organisms"; from them, the study of the different groups of organisms began, in correspondence with the system in 5 kingdoms.

Consequently, in the Biology Program of seventh grade, when studying the importance of plants, only took into account their significance for nature, medicine, food, economy and industry; However, its link with the culture, history and affective life of the human being was little addressed, this being a primary need for the development of an environmental awareness and ethical and aesthetic values, necessary for the environmental education of the student. This could be affecting understanding by educating of the intrinsic value of biodiversity and affective dimensions, is ethics and ethics of conservation, limiting knowledge of another goods and services ecosystem offering in nature.

In regard to methodological guidance of Biology eight grade

(Hernandez Diaz, Fumero & Campusano, 1990), they addresses to the study of the fifth kingdom, the animal, following an order which takes into account the evolution upward from agencies simpler to those of greater structural complexity, which serves as the basis for the ninth grade. However, it is recognized that the study of nature was treated as a homogeneous and simplified whole without paying attention to its enormous diversity, fundamentally oriented towards the protection of the environment.

As for deductive procedures, they were conceived so that, based on biological generalizations, the student would operate with them in the analysis of particular cases of knowledge and apply them to new situations. This implied necessarily resorting to the antecedent concepts, formed in previous units and grades and that should be the domain of the students, but in practice this was not always the case; For they did not form conceptual structures that allow the representation of what they learned, either due to the non-use of adequate methodological procedures or because they learned by heart, with the consequent appearance of forgetfulness.

The origin of the term biodiversity appears e n 1985 and was coined by Walter (1985), during the first meeting to plan the National Biodiversity Forum, which was held in Washington, DC, under the auspices of the National Academy of Sciences and the Smithsonian Institute, in 1986. The memory of that event was edited by Wilson (1988) under the title Biodiversity, which led to the dissemination of this term for its use; "The signifier `biodiversity'.

In this stage, the 1992 Convention on Biological Diversity (CBD) stands out, which was signed on June 5, 1992 in Rio de Janeiro (Brazil) and laid the international political and legal bases for environmental care. The main objectives of the CBD were the reduction of the loss of biodiversity, the sustainable use of resources and a fair and equitable distribution of the benefits derived from the use of genetic resources, including adequate access to them and the appropriate transfer of technologies. . In this way, biodiversity was defined in the CBD as "the variability between living organisms from all sources, including, among others, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part, such as the diversity within species, between species and ecosystems" (Bermúdez, 2018).

During this stage, the Ministry of Science, Technology and Environment (CITMA) was created in 1994, the declaration of Law No. 81 on the Environment of July 1997, which establishes the principles and norms of environmental policy in Cuba, the establishment and implementation of the National Environmental Strategy, the National Environmental Education Strategy (ENEA), among other important events, to deepen the environmental educational process at school with greater demand and legal protection. Methodological, pedagogical and didactic activities were also carried out in order to achieve an adequate process of greening the study plans and programs, as a contribution to environmental training.

As for the biological knowledge that the students had to learn at this stage, they were still dense, without resorting to the assimilation of the essentials and with little emphasis on the formative; For this reason, there was an intermediate stage, aimed at looking for a certain download in the programs, as a precedent of the modifications planned for the 1999-2000 academic year, in addition, it was not always based on an environmental diagnosis in the context of the community environment, which It will include the link with the way of life and the traditions of the population in the use and management of the biota, so that another perception of the local

biodiversity and its conservation will be fostered.

In relation to the above, the objectives in this stage do not achieve a true interaction of the learner with the different forms of life in the environment since more attention was paid to the instructional objectives, while the exit to the educational ones were insufficient, these were limited to promoting love for the different groups (in some, from an aesthetic approach), in their care, so that the term conservation, with a greater scope in environmental education, did not have the required emphasis, it was more used that of nature protection.

In accordance with the foregoing, it is evident that the improvement continued carrying teaching Biology traditionalist's paths employing the exhibition method; the programs were characterized by the breadth and depth of the subject matter. Thus, the reality proved that programs with wide breadth of contents contributed to the teacher used the expository method and not conducts to motivation for seeking information independently, the same as the determination of objectives, organization and control of practical activities.

In summary, this stage was characterized by the teaching of Biology based on programming axes and guiding ideas, which until today constitute the maximum generalizations of the content of its teaching, as well as the methods and techniques of Biological Sciences linked to them. The transmission of information on biological content is oriented with an encyclopedic character and a greater volume of theoretical knowledge. The study of the content of biodiversity is still being treated with the same level of depth than previous levels.

The use of independent work methods, joint elaboration, problem exposition, heuristics and research begins to be observed. The environmental dimension was oriented to the environment, but biodiversity, although alluded to and the object of research work with a more educational approach was not in all cases a central theme, treated as integrative knowledge. Regarding teaching tasks, it should be noted that although they mostly invite scientific justification, these are generally carried out by reproducing the information provided in the text, with few more demanding ones that allow synthesis or application of knowledge to new contexts and that promote a change in attitudes towards biodiversity.

Similarly, the practical activities recommended by the textbooks are limited and require a redesign to establish the relationships between the biological, geographical, historical, cultural and ethical contents, which contribute to a holistic and integrative conception of the environment, which will establish the cognitive bases for the development of feelings, convictions and ideals and, with it, a developing educational process, which will allow their motivation and performance of the students in the environmental environment.

Stage 2. (2000-2012): Treatment of biodiversity conten t in the framework of transformations in secondary education, with the training of the comprehensive general teacher.

In the stage, the determination of the objectives and general training contents, marks the beginning of this stage, in which the efforts to promote the integrality of the environmental educational process are manifested. The guiding programs and transverse axes in the curriculum are included, together with their targets; the direction that should be given to each of the subjects is oriented according to their potentialities; therefore, it constitutes a priority, although the methodological connotation of the treatment of biodiversity content is insufficient.

From 2004, changes are introduced in the Basic Secondary Model, which must

be executed by the Comprehensive General Teacher, an aspect that responds to the permanent improvement of the National Education System. The direction of the learning of biological concepts was organized with the use of information and communication technologies, from the observation of TV classes, videos, educational software and other teaching aids.

In this direction, the methodological procedure most used by the teacher for the teaching and learning of biodiversity was the observation of the television broadcast, which limits direct teacher-student and student interaction with the environment and exhaustive preparation of the teacher, who, being comprehensive in general, had to direct the learning of all the subjects. This situation causes the emphasis on laboratory practices and direct contact with nature to decrease, given that most of the practical demonstrations are presented in TV classes. The deductive path is maintained for the direction of the learning of biological concepts, in which the students, with the biological generalizations that they learned from TV classes, had to apply them to new situations in the face-to-face spaces of the process.

In the textbook Biology of eighth grade (Hernandez Diaz, Campuzano & Fumero, 1990), the treatment of biodiversity based on the referred conservation some measures, such as reforestation forest, closed seasons and protected areas, logging, hunting and fishing bans. However, the causes that produce the imbalance, the destruction of ecosystems and the loss of biodiversity as one of the most pressing environmental problems in the global sphere and who produces it and why , were not dealt with in depth; only the indiscriminate action of the human being was mentioned, being insufficient and formal.

Consequently, the importance of biodiversity was treated in a reductionist way since some services such as cultural, spiritual, religious, educational, aesthetic, recreational and symbolic were obviated, creating in the student a biased vision of biodiversity. Reducing it to the idea of a number of species. In this way, textbooks continue with the difficulty that learning tasks lack an interdisciplinary approach and the deductive path for the direction of learning biological concepts is maintained.

This is a stage immersed in the Decade of Education for Sustainable Development (2004 - 2014), declared by the United Nations and supported by Cuba, whose environmental practice already considered this perspective. These elements strengthen and provide strength to environmental training aimed at sustainable development. However, there are some shortcomings. The objectives set forth in the Basic Secondary Model, although they refer to environmental education, lack precision and coherence in the intentionality and gradation required by the leading performance of the student.

In this order of ideas, from the normative documents that guided the environmental educational work, the goal of educating individually and collectively towards the conservation and sustainable use of natural resources is outlined, in other words educating for sustainable development. One of these programmatic documents is the National Environmental Education Strategy for the five-year period 2011-2015, in which environmental problems are declared at the global, national and local levels, where the loss of biodiversity is found (CITMA, 2011).

As an expression of the efforts to specify the previous aspirations, in 2012 it published a new textbook of Natural Sciences for the seventh grade, where the environment is studied and the relationship that is established between its components is evident; emphasis is also placed on the importance for its

sustainable use and management, and the different layers of Earth planet are explained: lithosphere, atmosphere, hydrosphere and biosphere. In it, issues of Biology were also discussed, including the unity and diversity of living organisms that make up the different kingdoms, detailing in greater depth that of plants. However, it is evident as regularity that the same biological contents of the textbook of the previous program were taken into account and the importance of plants continues to be oriented towards nature and the utilitarian.

The use of procedures that involved the student in an active and leading way in environmental problems, especially biodiversity, was not enough. A vision limited to natural aspects prevails in the objectives, which limits the orientation towards the formative and integrative nature of environmental education as a solution to environmental problems. As can be seen, the importance of biodiversity oriented towards nature and the utilitarian prevails, not being so on the historical plane and as part of the culture of the peoples. At this stage, the treatment of biodiversity has a notable reduction in the contents and in the practical activities from the transformations.

As essential characteristics of the stage, events of special importance in environmental matters take place. The teaching-learning process of Biology is enriched with the incorporation of information and communication technologies, by introducing encyclopedias in electronic format, TV classes and materials from the Libertad Editorial Program, among others, which facilitated the search for the information for the subsequent construction of knowledge by the student.

The system of objectives is characterized by presenting a more demanding vision of the teaching-learning process of Biology with a formative character based on environmental education. Are explicit references to nature and incorporate the need to protect and especially plants and animals, however, their attention is not focused on the rational use of resources, but in ecosystems that are preserved in their natural state and the network of protected areas, as if this were enough to ensure the conservation of biodiversity.

There was a reduction, in the programs, in the volume of information and the number of excursions to nature that were carried out previously was considerably limited. Independent work methods continue to be used, mainly by tele-teachers and traditional teaching aids.

Stage 3. (2013 - 2017): Treatment of biodiversity conten t aimed at disciplinary integration and sustainable development as part of improvement.

This stage has been called as such, because in it the environmental education specified in the previous stage is continued and consolidated, with a direction towards sustainable development, a trend in education at a global level and as a response to the exacerbation of environmental problems in the global, regional and local scope with emphasis on the loss of biodiversity and the problems surrounding its conservation. The incorporation of the environmental dimension is assumed as a methodological resource that helps the orientation and integration, in the educational teaching process, of necessary environmental elements, as well as the readjustment of the study programs, under the adopted curricular conception.

In this way, the incorporation of objectives and contents aimed at environmental education is highlighted in the programs, although it is considered that even in the three grades the integration for the treatment of biodiversity was lacking. The contents related to the environment were not

located in a specific unit, since their study was not integrated into the content of the rest of the units, in order to achieve more meaningful and contextualized learning.

As for the objectives, they were organized in a logical, coherent and gradual way; although it was considered necessary to improve its production from a training, didactic approach developer, and achieve greater integration considering relations intra and inter-disciplinary, from the invariants of the content. In this way, emphasis was placed on the training component to demonstrate the importance of responsible behavior towards individual and collective health, to demonstrate love for nature.

With regard to the methods and procedures, they sometimes gave room for the reproduction of the content and a limited active and protagonist involvement of the student with the biodiversity of the environmental environment, sometimes unsystematic, depending on the methodological preparation and the motivation of the teacher of Biology to achieve the improvement of the management process for the assimilation of the teaching content, in particular that referred to the formation of concepts and development of skills. The validity of the guiding ideas formulated in 1987 is ratified at the stage, which is reflected in the Didactics of Biology book and in the methodological guidelines.

To achieve greater correspondence between the teaching of Biology and the preparation of the student for life, it is proposed to take into account the predominance of the deductive approach, to approach the formation of scientific concepts. The application of the forms of organization of the teaching-learning process was deepened, such as excursions to nature for the observation of objects and natural phenomena and types of classes such as: seminars, laboratory practices and practical classes, which lost their prominence and that they were essential in the general and comprehensive training of the students.

In this way, in the face of the urgency of the ecological drama that climate change represents in the stage and its associated risks, Cuba adopts a state plan entitled *"Tarea Vida"* as an expression of the urgencies it assumes to confront climate change on a multidisciplinary scientific basis. (CITMA, 2016). The project "Adaptation of coastal settlements in Cuba to the threats of climate change with an approach based on ecosystems" (CITMA, 2017) stands out in particular.

In this sense, the teaching of biology played an important role in the development of environmental educational actions for the formation of knowledge, convictions, attitudes and responsible behaviors in students to protect and conserve the environment in general and biodiversity in particular. In summary, this stage was characterized by the existence of a balance between the contents related to biodiversity and the educational and training aspect that should characterize the process. The employment of methods involving to the student in environmental issues, especially biodiversity was not enough and although it has moved in the direction of the objectives and content to enhance education in the conservation of biodiversity, its application in practice was limited.

Stage 4. (2018-2021): The didactic-methodological update of the biodiversity content as part of the Third Perfection of the National Education System.

The content of this stage responds to the demands of the integral formation of the Basic Secondary student raised at the end of this level of education and its objectives, which have been specified in the Curriculum of this education in the third stage of Perfecting the National Education System in Cuba and intends to

deepen and update the biological contents in light of the advances of the biological sciences until the beginning of this XXI century, as well as the most advanced didactic approaches in correspondence with the achievements of Cuban pedagogy, which was contextualized in the Conception of the Biology Discipline in General, Polytechnic and Labor Education.

In the educational l Basic Secondary leve, new contents are introduced, systematized, they deepen and apply other already studied at the primary level in the subject Natural Sciences, biological contents were organized from biodiversity focusing explanatory integrator, evolutionary , eco systemic and bioethical, organized in systematic groups according to Woese's classification in the Archaea, Bacteria and Eukarya Domains and within the latter the Protista, Fungi , Plantae and Animalia kingdoms.

Consequently, the unity of diversity that is evidenced in each of these groups of organisms is emphasized, where structure-function relationships and interactions that occur in the organism as a whole are analyzed, where biotic integrity is verified. Each systematic group is studied its unity and diversity through the essential characteristics, their adaptations to the environment, the importance in nature and society in general, protection, conservation and sustainable use, and their evolutionary relationships with the rest.

In the Biology 1 program proposal, the objectives of the discipline and the subject are updated, which constitute a derivation from the general objectives and the grade at the intermediate level, which are contained in the Study Plan, contextualized to the contents of Biology in this grade. Likewise, the objectives of each of the units are included, derived from the objectives of the subject, based on their contextualization in the contents of the unit (Medina & Chacón, 2019). In this way, the Biology 1 subject is made up of eight units.

In general, unit one corresponds to the introduction, which analyzes the importance of the study of biology throughout history to the present day, among other topics. In the second unit the study of the unit is introduced and diversity of the living world. The third unit refers to the study of the relationships established between organisms and the environment. In four unit the microscopic world is studied and the essential characteristics that identify viruses, bacteria and protists are analyzed, as well as their diversity, importance and relationships with human beings.

The fifth unit is dedicated to the study of fungi, their essential characteristics, diversity, importance and relationships with human beings. The sixth unit covers the study of plants, their essential characteristics, and their origin as a result of the evolutionary process, the different groups, characteristics, diversity and their evolutionary relationships. The seventh unit deals with the applications of plants by mankind and their impacts, conservation, sustainable agriculture and other uses.

In the eighth unit, a generalizing systematization of the contents treated in the program is carried out and they are fundamentally directed to ecological relationships and evolution of life on Earth, the diversity and distribution of the domains and kingdoms studied, their unity and evolutionary relationships, the treatment of ecosystems and the conservation and sustainability of the environment, with an emphasis on the protection of biodiversity.

Consequently, the methods and forms of organization of the process are designed to be active, productive, give space for creative and evaluative activity by students, and promote practical activities in laboratories and in other spaces of the

school and the community such as orchards, gardens, zoos, museums, among others, so that knowledge is appropriate from objective reality through the experiences and experiences of students. Teaching aids based on management knowledge is reinforced from the audiovisual and Educative Software , the Intranet and Internet, and the use of these telecommunication resources for interaction with teaching staff and the learners in carrying out joint tasks, and in participating in forums and blogs.

With regard to the eighth grade Biology program, a first generalizing unit is proposed where the characteristics common to organisms are addressed, the different groups are studied in evolutionary order, grouped into the simplest organization animals (poriferous), then the animals radial symmetry (coelenterates), then the animals of bilateral symmetry not coelomates
then the bilaterios coelomates not chordates, chordates coelomates grouped into two series: fish and tetrapods.

Finally, it introduces the eighth unit untitled, conservation of the biodiversity on Earth, in which the content relating the importance of the care and conservation of biodiversity are studied, and their contribution in achieving sustainable development, the main causes that cause its loss. It is proposed, in addition, practical activities for the observation biodiversity through excursions. (Ministr y of Education, 2016).

In 2019, due to the appearance of the epidemic outbreak of an infectious disease produced by the severe acute respiratory syndrome corona virus 2 (SARS-CoV-2), also known as COVID-19 (acronym for the English Corona Virus Disease 2019) (Ribot Reyes, Chang & González, 2020) and extended in 2021, the Ministry of Education in Cuba adopted in the education Secondary Basic group of measures , among others, the related to the adjustments to teachers' schedul es, study programs of the biology subjects and transmission of content through TV classes, where workshops and seminars as a variant for the assessment of learners are oriented; For example, contents referring to the subjects of Natural Sciences, Ancient and Medieval History, Civic Education, Spanish Literature, Geography, Physics, among others, are integrated.

In short, this stage was characterized by, updating the content biodiversity as part of the Third Perfecting of the national education system , the transition from the multidisciplinary approach of the content of biodiversity, to the trans disciplinary in each subject at this educational level maintains an approach in which knowledge is shared and recognized separately, until the integration of knowledge of these through interdisciplinary; in this way, the boundaries between subjects are completely eliminated. Practical activities in nature were affected because of the quarantine measures and social isolation to prevent the spread of the outbreak.

In general, the analysis based on selected indicators show the following trends that summarize treatment biodiversity content:

1. The established stages have been marked by the development of international scientific events of special importance in environmental matters and the implementation in Basic Secondary Biology programs of the principles and objectives of environmental education for sustainable development.

2. It moves from a theoretical-practical conception of the content of biodiversity with a high level of information and

specialization, towards one more adjusted to the contemporary essential requirements and, although progress has been made in the orientation of the objectives to favor education in the conservation of biodiversity, its application in practice has not yet been achieved as an aspiration.

3. The teaching methods and methodological procedures range from oral presentation methods, with the use of traditional resources divorced from the immediate environmental reality, to the use of investigative methods with a system approach, which helped to improve the acquisition of knowledge in the students, a contextualized learning of biodiversity and the need to protect it in nature.

4. The use of teaching and learning aids, ranging from the traditional ones to incorporating the new model of educational technology in which the realization of practical activities in nature is reduced to their observation in the classroom through video classes, limiting this form, the link of the learner with the different ways of life that inhabit the nearby educational and community environment.

5. The study programs go from a predominantly instructive to an educational nature; The system of biological generalizations that has the integrity of nature as its central axis is reinforced as part of the improvement, emphasizing the unity and diversity of the living world, the structure-function relationships and the interactions that occur in the organism as a whole. However, in practice, there are still shortcomings in the conservation of biodiversity.

CONCLUSIONS

The historical trend study poses significant challenges to the teaching and learning of the content of biodiversity in the Basic secondary education level, which requires Professor of Biology with a permanent and systematic scientific updating; From this, the need to ensure that the reported content no longer only for the learner to learn about life, and become a content to teach to the student to learn to live and act in harmony to ensure the sustainability of biodiversity on earth. These forces pose major challenges that allow treating the biodiversity not as a conceptual tool, but as an object of knowledge that is configured in interaction with the environment education and community.

Thus, at this point, we consider that the treatment of biodiversity content should be conceived, as the determination of the elements that make up the didactic direction developed by teachers, from the objectives, content, methods and methodological procedures, which have as most external expression of the organizational forms of the teaching-learning process of Biology at school, to achieve meaningful learning as a result , the transformation of modes of action in students in different contexts, the development of essential skills and values for contextualization, significance and meaning in the process of appropriation of biological content.

BIBLIOGRAPHIC REFERENCES

Bermúdez, G. (2018). ¿Cómo tratan los libros de texto españoles la pérdida de labiodiversidad? Un estudio cuali-cuantitativo sobre el nivel de complejidad y el efecto de la editorial y año depublicación. *Revista Eureka sobre Enseñanza y Divulgación de las Ciencias 15*(1), 1102. https://doi:10.25267/Rev_Eurek

a_ensen_divulg_cienc.2018.v15.i1.1102

Castro, J., Valbuena E. (2007). ¿Qué biología enseñar y cómo hacerlo? *Tecné, Episteme y Didaxis, 22*(1), 126-145. https://doi.org/10.17227/ted.num22-385

Chacón, D.,Medina, D.,Milian, M., Blanco, Y.,Jardinot, R., Juanes, I., Luis, J., Castro, M, Castillo, Y.,& Roberto, G. (2019). *Libro de texto de Biología 1. Séptimo Grado*. La Habana: Pueblo y Educación.

Chacón, D.,Medina, D.,Jardinot, R., Milián, M., Juanes, I.,& Castillo, Y. (2019). *Orientaciones Metodológicas de Biología 1. Séptimo Grado.*La Habana: Pueblo y Educación.

García, J. & Martínez, F. (2010). Cómo y qué enseñar de la biodiversidad en la alfabetización científica. *Enseñanza de las ciencias*, *28*(2), 175-184. https://raco.cat/index.php/Ensenanza/article/view/199611

García, O. & Méndez, A. (2017). Hacia una resignificación de la enseñanza delcontenido del concepto de biodiversidad en biología (revisión). *Roca. Revista científico - Educacional De La Provincia Granma*, *13*(1), 158-170. Recuperado a partir de https://revistas.udg.co.cu/index.php/roca/article/view/1221.

García, O., Sánchez, M. & García, R. (2020). Aporte de un procedimiento didáctico paramejorar el conocimiento de la biodiversidad en Secundaria Básica. *Bio-grafía. Escritos sobre la Biología y su enseñanza*, *13*(25). Recuperado de: https://doi.org/10.17227/biografia.vol.13.num25-11575

Gil, Á., León, D. & Morales C. (2017). Los paradigmas de investigación educativa, desde una perspectiva crítica. *Conrado*, *13*(58), 72-74. Recuperado de: https://conrado.ucf.edu.cu/index.php/conrado/article/view/476

Hernández, J., Pérez-Puelles, N., Campuzano, N., Díaz, A., Santos, E., & Fumero, L. (1989). *Orientaciones metodológicas; Biología I, Séptimo Grado.* Ciudad deLa Habana: Pueblo y Educación.

Hernández, J., Díaz, A.,Campuzano, N., & Fumero, L. (1990). *Libro de texto de Biología 2. Octavo grado.* La Habana: Pueblo y Educación.

Hernández, J., Díaz, A., Fumero, L., & Campusano, N. (1990). *Orientaciones metodológicas*; *Biología 2, Octavo Grado*. La Habana: Pueblo y Educación.

Herrera, L. (2020). Saberes acerca de la biodiversidad en un escenario de educación no convencional. *Biografía. Escritos sobre la Biología y su enseñanza*, *11*(22), ISSN 2027-1034. pp. 55-66. https://doi.org/10.17227/biografia.vol.11.num22-11593

Martínez, X., García, I.& García J. (2019). Competencias para mejorar la argumentación y la toma de decisiones sobre conservación de la biodiversidad. *Enseñanza de las ciencias*, *37*(1), 55-70. Recuperado de: https://doi.org/10.5565/rev/ensciencias.2323

Medina, D., &Chacón, D. (2019). *Programa de Biología 1. Séptimo*

Grado. La Habana: Pueblo y Educación.

Ministerio de Educación. (1979). *Primer Seminario Nacional de Educación Ambiental*. La Habana.

Ministerio de Educación. (1989). *Libro de texto de Biología 1.Séptimo Grado*. La Habana: Pueblo y Educación.

Ministerio de Educación. (2016). *Programa de Biología 2. Octavo Grado. (Versión 1).* La Habana: [s/n].

Ministerio de Ciencia tecnología y Medio Ambiente. CITMA. (1997). *Ley No. 81 de Medio Ambiente.* La Habana.

Ministerio de Ciencia Tecnología y Medio Ambiente. CITMA. (2011). *Estrategia Nacional de Educación Ambiental 2011 -2015. La Habana:* Centro de Información Gestión y Educación Ambiental.

Ministerio de Ciencia Tecnología y Medio Ambiente. CITMA. (2016). *Plan de estado de la República de Cuba para contrarrestar los efectos del cambio climático*. La Habana: Ministerio de Ciencia, Tecnología y Medio ambiente.

Ministerio de Ciencia Tecnología y Medio Ambiente. CITMA. (2017). *Proyecto de investigación Adaptación de los asentamientos costeros en Cuba a las amenazas del cambio climático con un enfoque basado en ecosistemas*. La Habana: Ministerio de Ciencia, Tecnología y Medio Ambiente.

Organización de las Naciones Unidas. (1992). *Convenio sobre Diversidad Biológica* (CDB). Rio de Janeiro. Recuperado de: https://www.cbd.int/doc/legal/cbd-es.pdf

Rodríguez, R., Pedro, P., Esther, C., Bacardí, F., Fernández, M., Santos, E., Matos, C., Carvajal, C.,&Berta, A. (2012). *Libro de texto de Ciencias Naturales.* 7mo. Grado. La Habana: Pueblo y Educación.

Ribot, VC., Chang, N.,&González, AL. (2020). Efectos de la COVID-19 en la salud mental de la población. *Revhabanciencméd*, *19*(Supl.): e3307. Recuperado de: http://www.revhabanera.sld.cu/index.php/rhab/article/view/3307

Salcedo, I., Hernández, J., del Llano, M., Mc Pherson, M., & Daudinot, I. (2002). *Didáctica de la Biología*. (2da ed.). La Habana: Pueblo y Educación.

Santos-Ellakuria, I. (2019). Propuesta para mejorar la didáctica de la biodiversidad en la asignatura de Biología y Geología de 4º de ESO. *Ikastorratza. e-Revista de Didáctica, 22*, 90-121. Recuperado de: http://www.ehu.es/ikastorratza/22_alea/6.pdf

Van Weelie, D. y Boersma, K. (2018). Recontextualising biodiversity in school practice. *Journal of Biological Education, 52*(3), 262-270. Recuperado de: https://doi.org/10.1080/00219266.2017.1338596

Wilson, E.O. (1988). *Biodiversity.* Washington: National Academy Press.

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