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# *Enseñar y aprender Biología desde el enfoque sociocultural-profesional*

## *Biology teaching and learning from a socio-cultural-professional approach*

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**Resumen:** La enseñanza actual de la Biología está marcada por el impacto del desarrollo científico y tecnológico, por lo cual resulta necesario buscar vías que propicien el enfoque sociocultural-profesional en su enseñanza-aprendizaje y con ello contextualizar los hechos, fenómenos y procesos con su impacto social. En consecuencia se presenta una propuesta de tareas integradoras con enfoque sociocultural-profesional para el proceso de enseñanza-aprendizaje de la Biología. Los métodos empleados fueron la revisión documental, el histórico - lógico, y el analítico-sintético que permitieron llegar a conclusiones de la pertinencia de este enfoque en la manera de enseñar y aprender Biología.

**Palabras clave:** Biología; Enfoque Sociocultural-Profesional; Enseñanza-aprendizaje; Tareas integradoras con enfoque sociocultural-profesional

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**Abstract:** The current teaching of biology is marked by the impact of scientific and technological development, so it is necessary to search for ways that foster a socio-cultural-professional approach in teaching and learning and contextualize the facts, phenomena and processes with their social impact. Consequently, a proposal of integrative tasks with a socio-cultural-professional approach is presented in this paper for the teaching-learning process of Biology. The methods used were documents' analysis, historical -logical, and analysis -synthesis which allowed us to reach to conclusions about the relevance of this approach in the way of teaching and learning biology.

**Keywords:** Biology; Socio-cultural-professional approach; Teaching-learning; Integrative tasks with a sociocultural-professional approach

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## **Introduction**

The world is in a great sociocultural revolution based on the vertiginous development and practical and technological applications of science, which makes possible that the teaching - learning of the sciences is also a vital sociocultural activity and implies that knowledge is continuously updated.

In correspondence with the above, the sociocultural-professional approach in the teaching of science corresponds to the need to achieve certain changes in teaching attuned with the current role of the development, a subject of occupation and debate at different levels, highlighting the research

of Addine (2006), and the work of Daniel (1993), Valdés, P. (2003), Valdés, R. (1999), Rodríguez; Moltó; Vilchés; Furió and Bermúdez; and Torres (2008).

Such research recognizes that the teaching-learning process with a socio-cultural-professional approach is usually not conceived in a way that follows a specific model, so that new conceptions of science teaching and learning are left somewhat to the use of situations or spontaneous changes that will contribute to the didactic changes only through a cumulative effect.

Related to the above, in the teaching-learning process of Biology the following shortcomings stand out:

1. Traditional approach to content structuring.
2. Descriptive treatment of the contents of this teaching discipline with a marked role of the teacher that leads to a memorizing and reproductive learning.
3. Insufficient solidity of the knowledge of the students and the few possibilities that, in rare opportunities are offered to use the knowledge of science, its applications and the methods of scientific activity that lack new contextualized situations of learning.

These problems do not allow us to respond to the sociocultural demands of these times, to the needs of the curricula, nor to the dizzying changes of the knowledge society, which indicates the urgent need for a profound change in conceptions about teaching-learning in science. In this sense, the eminent physicist and teacher Kapitsa (1985) warned: "When we teach students or schoolchildren, the fundamental condition necessary is the individual's desire to learn. It is well known that if he does not experience such a desire, it is not possible to teach him... It is evident that for the desire to manifest, it is necessary to create favorable moral and material conditions ... to learn what is new is the number one condition for feeling that doing so would be advantageous, useful and honorable" (pp. 209-210).

In relation to the above, it is important to emphasize González and Mitjans' (1989) assertions: the characteristics of plans and curricula, and especially the way they are taught, will contribute to the development of interests and capacities linked to a specific area of knowledge. It has been demonstrated in innumerable papers that students sometimes develop rejection for certain subjects, not because of their content, but because of the way in which they are taught" (p.196).

This has to do with the fact that many teachers do not relate the socio-cultural aspects of the science content of their social impact, so they lack meaning and as a consequence learning is difficult.

It is significant that the current orientations of the researchs carried out by different specialists and the program for the science teaching disciplines, do not devise the ways for the socio-cultural-professional approach of the content that allows to learn and to teach in correspondence with the current scientific and technological changes.

With this work, a proposal is made, consisting of integrative tasks to promote the socio-cultural-professional approach in the teaching-learning process of Biology, in a way that guarantees a greater pedagogical reach to learn and teach it.

## **Development**

The scientific discoveries demand that the professors who teach Biology understand that it is not enough to master the system of knowledge to be able to teach it properly, but also to reflect on its teaching practice and characterize this school science, which differs from that produced by the community scientific basis.

We refer to what is taught and learned in school, a biology with meaning for the life of the students, not only updated, consistent with their new discoveries, but also contribute to logical thinking and heuristics, to the formation of ethical citizens, who apply basic concepts of biology to solve everyday problems in a responsible way; a biology that can penetrate reality in a mediate and generalized way, that equips the students with an instrumental-procedural system that enables them to develop systems of actions and operations with generalizing bases, and thus perform tasks or activities that includes problems that are significant and of interest related to their reality and in general to life, and for which they must employ scientific advances, methods and procedures of science.

It is to stimulate the potential of the students so that they can give solution to the contradictions that are generated in the teaching - learning process of Biology.

Taking into account the above, in the teaching-learning process of Biology, different approaches have been developed with the aim of achieving a meaningful learning that in turn fosters a high independence in the cognitive and volitional sphere that foster a scientific culture for understand its environment and explain it scientifically, but above all, to transform it with a socialist social perspective.

Within these approaches, the authors assume those systematized by Dr. María Magdalena Pérez Valdés in her doctoral thesis (2014):

1. Teaching-learning by transmission reception.
2. Learning by discovery, autonomous or guided.
3. Significant transmission-reception expository teaching.
4. Problem teaching.
5. Interdisciplinary or integrative
6. Learning science through conceptual change
7. Teaching through directed research.
8. Teaching by explaining and contrasting models.
9. Teaching-learning of sciences as a socio-cultural and research experience.

The teaching-learning didactic approach of the sciences as a socio-cultural and investigative experience constitutes an important reference. From the perspectives of this research, the authors assume their three fundamental postulates:

1. Print a sociocultural approach to the teaching of science.
2. Consider, in the teaching-learning process, the distinctive features of contemporary scientific research activity.
3. To take into account the characteristics of human psychic activity in the teaching-learning process of science.
4. The first of these postulates assumes:
  - a) to reveal, in the teaching-learning process, the social nature of the facts, phenomena and processes of the sciences,
  - b) to include with the content of teaching-learning the main elements of the historical-social experience, which include the main milestones in the history of science and its social impact.

It is the authors' criterion that it is not a matter of "updating" only the knowledge system of the sciences; it implies an update and contextualization aimed at relating the biological objects, facts and phenomena with their social impact, the practical, technological and social applications of the same, and with that, make it possible for students to acquire the modes of professional action ,

related fundamentally to the mastery of the Biology knowledge system, the design of experimental activities and the relevance of a practical - experimental thinking, the use of the novel advances in biology didactics, among which is the work with the relations science-technology-society, employing the methods, ways and procedures peculiar to the investigative activity.

It is then legitimate to state that it is necessary to organize the teaching-learning process of Biology as a contemporary research activity, based on the origin of the cognitive processes is the approach of teaching tasks, questions or problems (process of familiarization with the situation, in which it is analyzed from multiple perspectives), in this way the teaching tasks, questions or problems acquire meaning for the student and motivates him to seek the solution, as long as he is in accordance with his cognitive possibilities and reflects his social and individual needs.

This process of solving teaching tasks, questions, or problems is composed of a network of actions subordinate to objectives that the student poses (search for scientific information in the most diverse sources, formulation of new questions and problems derived from the research being carried out, and the preparation and oral presentation of reports that reflect the results obtained).

The authors agree that many of these aspects have traditionally been relegated to the teaching-learning process of biology. They constitute a starting point, not only for the student to learn to deepen the issues under study, but to learn independently and train his creative and intellectual abilities to appropriate new ideas and attitudes, or to transform their structure cognitive about some subject that already had previous points of view and knowledge, being significant.

The above allows to consider in the teaching-learning process of Biology the construction of the systems of teaching tasks that encourage the work of the students so that, from the class itself, deploy all the potential of their creative capacity in correspondence with a suitable degree of motivation, that is reached in the teaching activity itself in the course of the solution of the tasks assigned to it.

Taking into account the above, it is therefore legitimate to refer to the definition made by the specialist Torres (2008) on socio-cultural-professional approach to the teaching-learning process of science.

The sociocultural-professional approach to the teaching-learning process of science is understood as the direction of the teaching-learning process of the sciences, which considers not only knowledge and know-how, but also considers in a special way the value of knowledge and the fact of that

science is a cultural vehicle that develops in students a reflexive attitude that empowers them in the understanding of their environment and allows them to consciously participate in decision making for the achievement of sustainable development. It materializes in the planes: economic, environmental, humanistic, technological, ideological-political and historical, in systemic interaction. It must contribute to the formation of scientific thinking, not only for the rigorous mastery of the knowledge system approved by the contemporary scientific community, but also for reproducing in the construction of knowledge and skills: the methods, ethics and style of work of the scientists (p.60).

From the above definition, the authors conclude that the teaching-learning of biology with a socio-cultural-professional approach must be strongly impregnated by the following traits:

1. Biology occupies a transcendental place in the formation of the graduate that demands the current Cuban socialist society and the scientific-technical advances that are generated daily.
2. Biology as a teaching discipline has its theoretical-conceptual system and methods to contextualize facts, phenomena and biological processes to school conditions, *i. e.*, relate biological knowledge with its impact and social applications.
3. The methods, ethics and work style of scientists, make them teaching methods that converge in the method of teaching-learning by directed research that allows reproduce in the context of the ethical and work style that characterize the action of the scientists
4. Development of reflective thinking in students through the use of methodology for the solution of biological problems related to the social impact of biological knowledge.

The above features justify the fact that directing the teaching-learning process of biology from the socio-cultural-professional approach requires designing and developing activities that, close to the conditions of scientific creation, enable a protagonic attitude of inquiry and search for the knowledge to understand the problems that are generated around this one. In this way, learning will imply the integration of the purpose of learning and developing the intellect, insofar as they are taught to think, to express their ideas, to reflect, to argue and to value what they learn, and thus to operate with knowledge towards new and higher levels of demand. Within the activities, the authors defend the so-called integrative tasks that become the premise and result of orienting the teaching-learning process of Biology from the socio-cultural-professional approach.

The integrative task, according to Abad (2009), is interpreted as an activity structured by a system of actions and operations that leads to the formation of integrated knowledge. Through it the student establishes relationships with the subjects involved in the process and with the object of study in order to comprehend fully facts, phenomena and processes of contextualized reality, as well as to manifest a conscious, active, transforming and creative action with it.

On the other hand it coincides with Del Sol, Hernández and Arteaga (2014) when they pose:

The integrative task is that type of teaching task oriented to the solution of one or several problems, theoretical, theoretical - practical and practical, for which the student requires the use of knowledge and skills acquired in one or several subjects of the curriculum (p . 3).

This definition constitutes an important antecedent for the authors to define an integrative task with a socio-cultural-professional approach as the type of teaching task aimed at solving one or several problems that are significant, related to the development and practical and technological applications of the sciences to equip students with the tools of scientific activity necessary for the appropriation of the knowledge of the sciences in relation to the existing ones and, in this way, to develop modes of action.

Through the integrative task with a socio-cultural-professional approach, the student appropriates a scientific, integrated and contextualized conception of reality; enables the execution of mental processes; power the appropriation of learning related to the dynamics of the research work in its different phases; allows us to understand the essence of the process of solving the problems of practical and professional life; helps to form a more global vision of the impact of biology in the teaching-learning process; contributes to developing the capacity to solve problems related to the social impact of biological knowledge.

On the other hand, it allows to contextualize the content of Biology in correspondence with the approaches that underlie its teaching and learning and at the same time equip students with the necessary tools for the appropriation of their knowledge in relation to existing ones, revealing the social nature of the same and the educational orientation science-technology-society as opposed to the traditional form of its approach in the education, so that it guarantees a greater pedagogic reach to learn and to teach it.

Contextualization addresses the need to confront the student to the interpretation of problems and results related to biology, their understanding of their significance and importance, as long as they are able to explain and make assessments from their points of view, so that they achieve the



presentation of new proposals and their arguments.

The researchers assume this as a premise that regulates the decision-making didactic about the inclusion of the socio-cultural-professional approach based on the interrelation of biological knowledge and its practical and technological applications in the educational context, which allows a social analysis from comparative criteria related to the political, ideological, cultural, ethical, aesthetic and economic with other contexts, incorporating modes of action in the student.

According to the analyzed, it is considered fair to highlight a group of aspects that need to be taken into account in the design of the integrative tasks with a sociocultural-professional approach in the teaching-learning process of Biology, these are:

1. The general formative objectives, of the degree, and those of the subject of the degree.
  2. The potentialities of biological knowledge for its contextualization.
  3. The sequentiality of tasks. This aspect refers to the order in which integrative tasks will be presented. Here the quantity and degree of complexity must be kept in mind.
  4. The moment of the course in which they will be oriented. In this aspect the logic of content development must be considered, so it is necessary to determine the biological knowledge assimilated by the student until the moment they are going to be oriented, so that they can make use of them in their solution.
  5. Indicators to be taken into account for the evaluation of integrative tasks
- It is permissible to argue that none of these aspects can be ignored at the moment of conceiving the integrative tasks with a socio-cultural-professional approach that will be presented to the students.

Based on these aspects, a proposal is made to design the integrative tasks with a socio-cultural-professional approach, which is described below:

The first aspect to consider in the proposal is the analysis of the general training objectives, the objectives of the degree and the objectives of the Biology subject, this step has as purpose to specify the main components of knowledge and power that students should appropriate in the subject Biology. This moment is also conducive to determining the possibilities of the content for its contextualization.

In the second moment the invariants of the subject Biology according to the Ministerial Resolution 226/03 are analyzed and its possibilities of contextualization.

In the third moment we move on to the design of integrative tasks with a socio-cultural-professional approach. In this step, not only the tasks should be designed, but also decisions must be made regarding:

- Time to plan, assign, monitor and evaluate.
- Order of presentation (sequentiality). In order to do so, the degree of complexity and the degree of difficulty are taken into account, the latter being analyzed in close relation with the results of the diagnosis of each of the students.
- Individual and collective assessment of students

Two examples of integrative tasks are presented to teach and learn Biology from the socio-cultural-professional perspective.

### **Example 1**

Analyze the following situation:

Many chemical reactions occur daily in nature. The man in the home, in the industries, in the medicine and in agriculture uses them to obtain calorific energy and new substances, to fight diseases, also in the human organism different processes are realized, one of them is the one of the cellular respiration in which one of the aforementioned reactions occurs at the cellular level.

- a) Represent the chemical equation of the aerobic respiration process. Refer to the chemicals that are needed in this process. Name them. Classify the reaction equation according to the criteria studied.
- b) Identify the level of organization of the matter present in this chemical equation. Classify in biotic or abiotic. Argue your answer.
- c) The substances, resulting from the process described above, are used by plants. Identify the process in which they are used. Plot the equation. Argue its importance for life.
- d) Identify the biomolecules present in these reactions. Classify them into organic and / or inorganic. Argue the industrial importance of each of them.
- e) One of the reactions of nature that man uses in the home is the following:  
$$\text{CH}_4 (\text{g}) + \text{O}_2 (\text{g}) = \text{CO}_2 (\text{g}) + \text{H}_2\text{O} (\text{g}).$$
 Assess the importance and effects of the substance marked for the life of man. Propose measures to avoid the effects of this substance in nature.

- f) In the previous reaction identify a Hydrocarbon, classify and name it.
- g) The previous Hydrocarbon is obtained from fossil fuels. Find on the map of Cuba, natural resources and the main sources of these.
- h) The joint declaration for the application of ALBA addresses the topic of Hydrocarbons. Say what the ALBA is and mention what agreements Cuba and Venezuela reached with regard to fuels.
- i) Argues your opinion on this and other collaboration agreements for the integration of Latin America and the Caribbean.

### **Example 2**

Deoxyribonucleic acid, often abbreviated as DNA, is a type of nucleic acid, a macromolecule that is part of all cells. It contains the genetic information used in the development and functioning of known organisms and some viruses such as the Zika, and is responsible for its hereditary transmission.

- a) Look at the biology textbook figure twelfth grade and identify both strands of DNA.
- b) Identifies what limitations the figure has in correspondence with the molecular and structural characteristics of DNA and on the basis of them, elaborates a model where the molecular characteristics can be appreciated in 3D
- c) James Watson and Francis Crick conceived the model of the DNA molecule that revolutionized Molecular Biology, elaborates a scientific account that reveals the scientific procedures of this transcendent finding, as well as the impact that the discovery of the structure has had for society of DNA in gene therapy investigations, recombinant DNA technique and gene splicing?

### **Conclusions**

The socio-cultural-professional approach is not only a theoretical question, academic, but above all a practice, a way of thinking and proceeding to know and solve any problem of reality where the student develops. It means a change of position before the problems of knowledge and the substitution of an atomized vision for a contextualized one of the biological knowledge.

The introduction of this approach implies a profound transformation in teaching methods and requires a change of attitude and relationships between the subjects involved in the educational

process. It requires a teacher who has socio-cultural-professional thinking as a premise so that he can transmit this way of thinking and proceeding to all his students.

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