INTERDISCIPLINARITY – A REQUISITE OF MODERN EDUCATION

Viorica BOACĂ, Codruţa GAVRILĂ, Mihaela – Luminița MILOȘ

Banat's University Of Agricultural Sciences And Veterinary Medicine „King Michael I Of Romania" Timişoara
Faculty of Agriculture,Department of Teacher Training, Aradului Boulevard,Nr.119, vioricaboaca@gmail.com

Abstract. *The premise for this paper was that interdisciplinary teaching – learning is a requisite of modern, formative education. Correlation of the knowledge from various school subjects plays a major part in achieving education as well as in the formation and development of flexible thinking, of the capacity to put the knowledge into practice. Through correlation, knowledge from different fields is better consolidated and systematized, as one discipline helps to the better learning of the other. In this regard, the paper presents a few suggestions on how to approach some contents studied during Biology classes, taking into account the principle of interdisciplinarity.*

Key words: *interdisciplinarity, educational activities, modern education*

INTRODUCTION

Modern teaching relies more and more on the concept of interdisciplinarity in the educational process, because the focus in education must be placed on learning awareness, on cooperation, on critical thinking and on the selection of information.

From the point of view of the teaching-learning process, S. CRISTEA defines interdisciplinarity in teaching as *"all the relations and interactions between the various contents and messages involved in a teaching / educational process, with purposeful relevance on the formation and development of the student's personality"* (CRISTEA, S., 1998: p. 240).

Therefore, interdisciplinarity requires the transfer of results from one school subject to another for the better understanding of phenomena. In this way, rather than having a one-sided view, a coordination of different points of view is achieved (NICOLA, I., 1994). From this perspective, BONTAȘ (1996: p. 93) defines interdisciplinarity (< L *inter* 'between') as *the coordination, at higher level, of two subjects within which meanings interact and complete each other, being thus able to reach a common content integrated under the form of border subjects such as chemistry – physics, biochemistry, socio-pedagogy, psycho-pedagogy, etc.*

Thus, as stated by L. D'HAINAUT (1981: p. 43 – 44), pedagogic interdisciplinarity lies at the basis of the educational curricula reformation that "[…] cannot be subjected to separated subjects in the tradition going back to Aristotle, and that no longer reflects contemporary epistemological reality".

Under the umbrella of the fundamental concept of interdisciplinarity, UNESCO studies define three operational ways of approaching school/university subjects:

a) *the intradisciplinary, vertical approach* – proposes teaching – learning – testing different notions and principles within a given school subject, stimulating "the security of knowledge", but also "the paradox of specialized encyclopaedism".

b) *the interdisciplinary, horizontal approach* – proposes the correlation of the contents of different school subjects, thus stimulating the rationalization of the formative relations between "the quantity of information" and "the amount of learning".

c) *the pluridisciplinary, transversal approach* – proposes solving some homework/ problems/ complex situations that rely on several subjects and organizational principles. This stimulates the capacity of integrating the information and its operationalization at the level of complex problems (CRISTEA, S., 1998: p. 241).

RESULTS AND DISCUSSION:

In the curriculum area "Mathematics and Natural Sciences, interdisciplinarity is mandatory, considering the direct applicability of biology, chemistry, physics and mathematics.

Interdisciplinarity within this curriculum area means studies and actions at the level of contents and methodologies that can offer knowledge of phenomena in their dynamics, thus opening the way for generalizing syntheses. In other words, the interdisciplinary perspective helps the student to "form a unitary image of reality" and to "develop integrative thinking" (STANCIU, M., 1999: p. 165).

In the process of studying biology, students' knowledge from different subjects can only be integrated from certain perspectives, which allows interdisciplinarity. Even if teachers teaching different subjects approach the same topics, it looks like they talk different "languages". It is difficult for the students to integrate by themselves the knowledge acquired from different subjects and to make up a global image of the objects, phenomena, and processes examined in class. Using inter-disciplinary links makes possible understanding the essence of the scientific conception of the world, its whole perception and the establishment of the causes of different connections existing in nature, studying the new items based on the old, known ones, enriching, and consolidating them. This also makes it possible to activate and enhance interest in acquiring new items of knowledge.

To conduct a series of lessons of biology in an inter-disciplinary manner, we need to take into account the following steps:

- *preparing the session*, which implies co-operation between the teachers with a view to point out that knowledge that can be used as inter-disciplinary at the educational level in discussion;
- *developing the questions and exercises* oriented towards the up-dating of the students knowledge;
- *selecting the graphic material* for the topic;
- *guiding the students* towards the understanding of the importance of phenomena studied: this is usually achieved by consecutive asking simple questions and solving exercises, thus contributing to the reaching of the educational goals.

Below are a few suggestions concerning the approach of some topics studied in animal biology classes based on the principles of interdisciplinarity:

- **Phylum *Protozoa***

Topic *Common Amoeba*: How does oxygen penetrate the amoeba's body? Common Amoeba, as well as other protozoans, breathes through its entire body area and oxygen penetrates the body through diffusion (*Diffusion*).

- **Phylum *Plathelminthes***

The functioning of suckers in flat worms is based on the difference in atmospheric pressure inside and outside them (*Liquid and gas pressure*).

Breathing is also based on diffusion (*Diffusion*).

- **Phylum *Annelida***

Mucus on the earthworm body surface eases its moving on the soil (*Friction force*).

- **Phylum *Arthropoda***

Class *Crustacea*

Crustaceans (as well as other organisms that move with the help of legs) function as lever systems (*Lever systems, Golden rule of mechanics*).

Class *Insecta*

The outer layer of wax of the chitin cover of insects protects their bodies from dehydration (*Evaporation*).

How can flies walk on the ceiling? They have suckers on their feet that function on the basis of the difference in atmospheric pressure (*Atmospheric pressure*).

Why is a mosquito's buzz higher than that of the fly? The sound we hear during a mosquito's flight is due to wing oscillations. A mosquito accomplishes 500-600 (some even 1000) wing movements per second, while a fly only makes 350. This is why a mosquito's flight is perceived as higher pitch by humans (*Sound waves*).

Bees distinguish several colours and shades: purple, yellow, blue, green-bluish, and dark red. Perceiving colour facilitates the spotting of nectar-producing plant species (*Colour spectrum*).

- **Phylum *Vertebrata***

Super-class *Pisces*

Fish have their bodies covered by mucus, which diminished friction during swimming in the water (*Friction*).

Small sea fish move in schools, and the shape of those schools reminds of a droplet of water. This shape provides the lowest resistance force of the environment during movement (fluid dynamics – Bernoulli's Law).

When they swim, the fish push the water behind them with their tail, thus propelling forward (Newton's Third Law).

Class *Amphibia*

Why is frog egg inside temperature higher than environmental temperature? The embryo inside the frog egg is dark coloured while its surrounding medium is transparent and spherical, thus concentrating solar light (*Heat effects, Optics*).

Class *Aves*

Why do birds fly in a V-shaped flock? The strongest of the birds leads the flight, its body "cutting" the air, followed by the other birds that keep a sharp angle flight. This pattern corresponds to a minimal air resistance force (*Aero-dynamics, Bernoulli's Law*).

Penguins make underwater ultra-sounds with a frequency up to 80 kHz, because they are adapted to land life and have a poor sight underwater (*Ultra-sound*).

Class *Mammalia*

Dolphins are endowed with similar sonar, that looks very much like bat sonar. It seems that the organ receiving ultra-short sounds is the fat layer located between the mouth and the air vesicles. Echolocation is also present in whales and rats (*Eco-location*).

CONCLUSIONS

Interdisciplinarity contributes to the optimization of education by offering a plural and dynamic vision on sciences, in concordance with real phenomena, painting the image of the fields of knowledge that permanently allow additions.

Teaching/ learning by correlating the school subjects brings novelty to the classroom, it activates the students, it stimulates their creativity and contributes to the unification of the educational process, working towards the formation of people with vast knowledge.

Approaching educational contents from an inter-disciplinary perspective allows us to help students broaden their horizon by applying their knowledge to other subjects too, preventing them from sticking to a single subject.

By understanding that in the study of any subject they can also refer to other subjects, students apply their knowledge in the solving of other problems too, in explaining phenomena, in perceiving the environment as a whole, as a functional system.

Interdisciplinary teaching focuses on the multiple aspects of child's development: intellectual, emotional, social, physical, and aesthetic.

BIBLIOGRAPHY

BONTAŞ, I. (1996). Pedagogie [Pedagogy]. Bucureşti*:* Editura ALL EDUCATIONAL.

CRĂCIUN, T., CRĂCIUN, L. (1989). Dicţionar de biologie [A Dictionary of Biology]. Bucureşti: Editura Albatros.

CRISTEA, S. (1998). Dicţionar de termeni pedagogici [A Dictionary of Pedagogical Terms]. Bucureşti: Editura Didactică şi Pedagogică.

D'HAINAUT, L. (1981). Programe de învăţământ pentru educaţia permanentă [Education programs for lifelong learning]. Bucureşti: Editura Didactică şi Pedagogică.

IONESCU, A. (1998). Atlas zoologic [Zoological Atlas]. Bucureşti: Editura Vox.

IONESCU, M., BOCOŞ, MUŞATA – Dacia (coord.) (2009). Tratat de didactică modernă [Treaty of modern didactics]. Piteti: Editura Paralela 45.

NICOLA, I. (1994). Pedagogie [Pedagogy].]. Bucureşti: Editura Didactică şi Pedagogică.

OPRIŞ, T. (1998). Aceste uimitoare plante şi animale [Those Amazing Plants and Animals]. Bucureşti: Editura Ion Creangă.

STANCIU, M. (1999). Reforma conţinuturilor învăţământului. Cadru metodologic. [The reform of teaching contents. Methodological framework] Iaşi: Editura Polirom.

*** M.E.C. (2007*).* Curriculum Naţional. Programe şcolare pentru aria curriculară: Matematică şi Ştiinţe [National Curricula. Mathematics and Science]. *Bucureşti.*