Contributed Paper

Precollege Biology Education in Argentina: A Preliminary Report

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Introduction

Basically, Argentina's educational system is set up in, at least, three levels — primario (elementary school), secundario (high school), and universitario (university). Only the elementary level (seven years) is compulsory. The adult literacy rate is 92%.

Each province or state (23 in total) is free to draw up its own curriculum (except for the university level). That means that operational plans for instruction vary greatly. Futhermore, there are situations that increase this variation of the curriculum even more:

•There are some universities that include an elementary school and a high school as part of their institutions.

• Municipalities, like the federal capital, sometimes have their own group of schools.

The central government also has a system of elementary and high schools, but these schools are in the process of being transferred to the provinces where they are located.

This extraordinary variation of the curriculum makes it difficult to present a single report on precollege biology education in Argentina. However, most of the Argentine population is concentrated in the province of Buenos Aires. Therefore, a brief presentation of the educational system of this province, as far as biology is concerned, will be illustrative of what students should know and be able to do in biology as a part of precollege training in Argentina.

Biology in Elementary School (Educación Primaria)

The elementary school is compulsory and goes from ages 6 to 12 in a seven-year period. The Buenos Aires province has an operational plan for instruction in the elementary school that has been in place since 1986. Biology is under the heading "Natural Sciences."

The curriculum rests on two major objectives:
• To provide equal educational opportunities for every person.

• To insure, in quantity and quality, a compulsory general education for everyone.

The rationale of the curriculum is based on the logic of science and the cognitive development of students. The scientific method is adapted as a didactic method, and two stages of cognitive development are recognized: concrete (6 or 7 to 11 or 12 years old) and formal (11 or 12 to 14 or 15 years old). The key of the concrete stage is activity related to the manipulation of hypotheses or propositions. The formal stage is related to the child's ability to deal with the hypothetical.

Ten unifying principles of biology are the basis for organizing the curriculum — genetic continuity of life; organic evolution; diversity and unity of life; relationships between structure and function, and between organization and activity; living beings and environment; biological roots of behavior; regulation and homeostasis; man and biological equilibrium on Earth; science as search for knowledge; and the history of biological concepts.

These 10 "principles" are viewed in two dimensions, contents and levels of organization. Contents include five major groups of organisms: Protista, Monera, Fungi, Plantae and Animalia. Levels of organization include atoms, molecules, cells, tissue, organ, organ systems, individual, population communities, ecosystems, Earth, planetary system.

In total, 222 activities/objectives are proposed. They are organized in two levels according to the cognitive development of students.

• Level 1 — Discovering chronological, spatial and causal relationships of the natural and cultural process (from first to fifth grade).

• Level 2 — Applying chronological, spatial and causal concepts in the exploration of the environment (6th and 7th grades).

On the other hand, the activities/objectives are organized in eight classes according to the subject of study:

•Organism structure (i.e. describe the respiratory process in plants—4th and 5th grades).
•Community structure (i.e. identify interspecific relationships, symbiosis, mutualisms, parasitisms and commensalisms—5th grade).
•Ecosystem structure (i.e. experimental activity probing the importance of the sun for the plants—5th grade).
•Earth structure (i.e. describe environmental characteristics of seasons—6th grade).
•Planetary system structure (i.e. identify evidence that demonstrates the shape of Earth through experiences—3rd grade).
•Cell structure (i.e. identify the cell as the basic unit of living beings—7th grade).
•Molecule structure (i.e. describe the elements that form a molecule—7th grade). Atom structure (i.e. describe the organization of the atom—7th grade).

Students spend around five hours per day (five days a week) in school, and each activity period lasts 40 minutes. Natural Sciences takes an average of 120 minutes a week. Thus, a period accounting for only 6-10% of total school hours is dedicated to the teaching of biology in elementary school.

Biology in the High School (Educación Secundaria)

The secondary school is not compulsory and goes from ages 13 to 17 (or 18) in a period of five (or six) years.

The Buenos Aires province has a curriculum that has been in place since 1986. Biology is under the general heading "Natural Sciences." The first three years of the instructional plan are considered the basic period. The fourth and fifth years are the higher level, and the student must choose among three areas of specialization: economics, science and pedagogy. An optional sixth year is an in-depth study of the area of specialization.

The students spend around five hours per day (five days a week) in school, and each activity period lasts 40 minutes. Natural Sciences takes an average of 80 minutes a week. Thus, a portion of time accounting for about 5-10% of total school hours is dedicated to the teaching of biology in high school.

First Year ... Natural Sciences in this year is under the heading of Introduction to Experimental Science, with a clear orientation to biology. The content is organized around the concept of structure. The following structures constitute the basis of the instructional plan: earth, ecosystem, community, organisms, molecules, atoms and cells. Fifty-nine activities/objectives are proposed (i.e. describe the structure and function of a unicellular organism by microscopic observations).

Second Year ... Natural Sciences is under the heading of Biological Sciences. The instructional plan is organized around three principles: energy, transportation systems (plants and animals), obtainment and consumption of oxygen. The plan lacks activities/objectives for this year.

Third Year ... Natural Sciences is under the heading of Biological Sciences. The instructional plan is organized around the following processes: metabolism, coordination of functions, genetics and reproduction. The plan lacks activities/objectives for this year and only provides details of contents under the main headings.

Fourth & Fifth Years ... At the beginning of these two years, the students choose an orientation. Those who choose Science as their orientation have three choices: social sciences, natural sciences and "exact" sciences (chemistry, mathematics, etc.).

Those who choose Natural Sciences have six courses in a two-year period. The first one is on "Education for Health," where the main concepts are health, environment and illness. The second one is on "Biological Sciences," where animal physiology (nutrition, respiration, etc.) is discussed. The third and fourth courses are laboratory practice. The fifth one is "Physical Anthropology," and the sixth one is "Biological Sciences," where the main concepts are adaptation of organisms to their environment, evolution, mutation, fossil evidence, evolution of living beings, evolution of man and evolution of the sciences.

The plan for the six courses consists only of a list of topics. The remaining students, those who choose social sciences or exact sciences, have very short courses or none on biology-related subjects.

Evaluation of Curricular Programs

Mechanisms have not been articulated for updating and constantly reevaluating these curricula. The lack of evaluation of these curricula makes it impossible to accurately assess their success (or lack thereof).

There are instructional materials available, including several textbooks, but most of them are poorly structured and often inaccurate or misleading; current conceptual understanding generally is not incorporated into these texts.

The preparation of future teachers needs drastic reform. Current content and pedagogical instruction is inadequate and teachers are not prepared to teach the current curricula. The situation will worsen in coming years unless teacher preparation becomes much stronger.

Recently, the central government, 10 provinces and the city of Buenos Aires, agreed to a pilot evaluation of student performance in the areas of Spanish and mathematics. More than 2000 students — 1174 students in the last year of elementary school and 1074 students in the last year of high school — were evaluated. In general, the performance of students was poor (i.e. only 33.47% of the students in elementary school were able to deal with fractions). This pilot evaluation was a step to the creation in the near future of a national system for evaluating education.

Conclusions

Argentina has impressive human and natural resources, but political conflict and uneven economic performances since World War II have impeded full realization of its considerable potential.

The lack of budgetary resources is the most serious problem facing the Argentina educational system. The consequent low salaries for teachers are the cause of frequent strikes that seriously disrupt the educational system. Teachers also lack the necessary resources, the time to reflect, and the opportunities to share ideas with other teachers. Under such conditions, it is difficult to instill a sense of exploration, curiosity or excitement in today's students.

In summary, there are three observations made concerning "Biology Education in Argentina" in this report:

1. In all grades, too little time is spent on biology instruction. Teachers and students should spend at least one hour a day on biology at all grades and take advantage of the many opportunities to connect biology to other school subjects.

2. All students need to learn more, and often different, biology. Important themes (especially in high school) are not found in the curriculum. The following are examples of missing themes:

- Biodiversity and its loss.
- Personal, social and ethical aspects of biology.
- Nature of technology.
- Biotechnology.
- The biological basis of behavior.
- Human influences on the biosphere.
- Overpopulation and resources.

Such oversight is the consequence of the lack of a modern curriculum framework.

3. There is a need to develop active learning environments through better use of discussions, laboratories, field experiences and educational technologies, all under the umbrella of inquiry-oriented instruction.