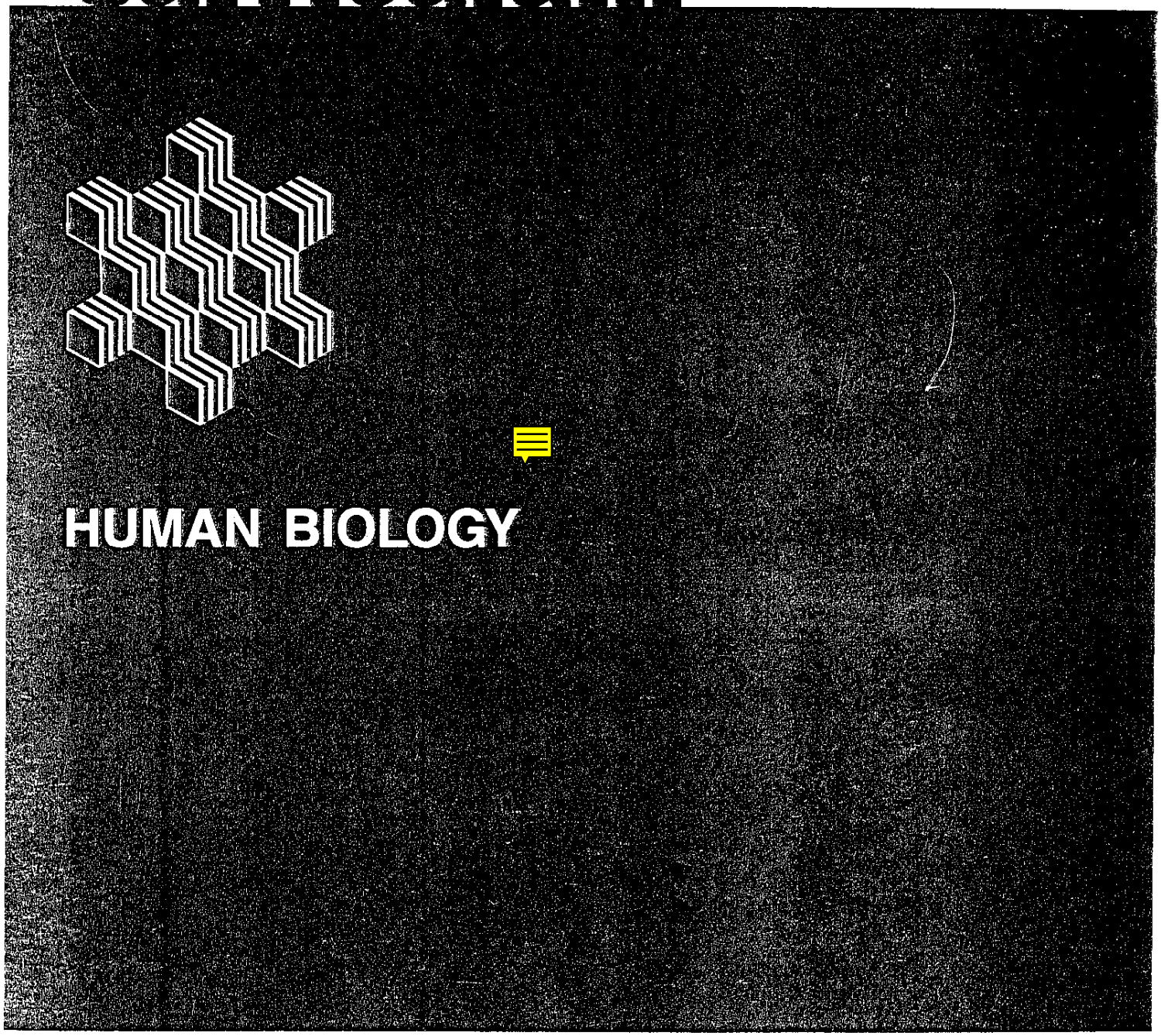
# Secondary School Curriculum



## HUMAN BIOLOGY

Québec

# Secondary School Curriculum

## HUMAN BIOLOGY

**Direction générale des programmes**
Direction de la formation générale

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les 18 décembre 1981 et 29 janvier 1982.



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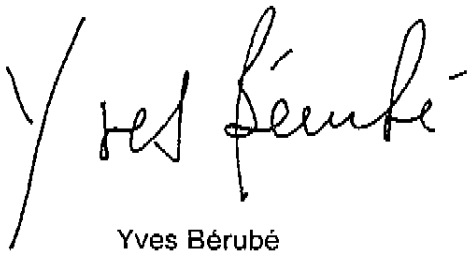
I am pleased to confirm that the course in *Human Biology*, Secondary School, issued in conformity with Section 3 of the Regulation Respecting the Basis of Secondary School Organization, has received the approval of the Confessional Committees of the Conseil supérieur de l'éducation and constitutes a course which I authorize for use in all schools beginning July 1, 1985.



Yves Bérubé
Minister of Education

## Acknowledgement

The Human Biology course was made possible through the cooperation of hundreds of persons who were consulted or who offered their comments during the planning or the preparation of the course.

On behalf of the ministère de l'Éducation of Quebec, the Direction générale du développement pédagogique and the Direction des programmes wish to thank:

— The teachers on the production team who, for almost two years, have devoted a great deal of energy to this course;

— the School Board representatives and the subject consultants for their availability and their contribution;

— all the biology teachers who took part in the formal consultation of October 1979;

— the specialists, associations, organizations, and all those who have given their wholehearted cooperation.

## Table of contents

## Foreword

This Human Biology course, on which secondary school biology teachers should base their teaching, is the official course.

The Directors of Instructional Services, the General Education Coordinators and the Science Consultants should base their development and support activities for the teaching of human biology on this course.

This document, which was prepared by the Direction générale du développement pédagogique of the Ministère de l'Éducation, Quebec in cooperation with teachers from the school boards, specifies the educational objectives for Secondary III.

The Human Biology course seeks to ensure an education that will lead to responsible behaviour in respect both to personal and to community health. To do so, it attempts to maintain a harmonious relationship between man and his environment.

A curriculum guide accompanies the course. This guide, the use of which is optional rather than compulsory, suggests various teaching approaches and provides more details on methodology, and references to resource materials.

## Introduction

### Justification

In recent years, many educational hypotheses have been developed: almost everything has been questioned, and the teaching of the natural sciences has been no exception. Numerous criticisms have been offered, some by science teachers themselves. Pupils' lack of interest has been linked with the elitism of the programs, with their unsuitability to the Quebec reality, and with their lack of meaning for young people.

As the same criticisms have also been directed towards biology, the Direction des programmes decided, in 1976, to reformulate the Biology 412 course. The revised version, presented in 1978 as Biology 442, offered a lighter content, suggested instructional objectives, and dealt mainly with health concepts and attitudes.

### New Orientations

At the same time, the **Green Paper** instituted an examination of the objectives of school education itself. Those responsible for secondary school science commenced a consideration of science teaching centered on unifying themes such as the environment.

In February 1979, following extensive public consultation, **The Policy Statement and Plan of Action** specified, in Chapter 2, the aims and objectives of school education and gave a new orientation for the courses to be provided for the schools. Chapter 7 indicated that the programs and courses would have more specific objectives and learning levels, which pupils should normally attain at various stages of their development in terms of content, skills, capacities, or techniques.(1)

Modifications in educational aims such as these require a revision of the courses and programs.

### New Restrictions

To ensure the implementation of the stated objectives of the Ministère's Plan of Action, Chapter 13 specifies the list of subjects to be taught and the time that should normally be devoted to each.

The course of Human Biology was thus placed in a new context:
— it is to be compulsory for everyone
— it is to be taught in Secondary III
— the instructional time suggested is 100 hours.

This changed context which affects the clientele, the time allocated, and the place of the course in the school curriculum entailed a revision of the main components of the Biology course.

The new general education course in "Human Biology" thus derives from **The Schools of Québec.**

### Development of the Course

To respond to the needs, orientations, and requirements presented in **The Schools of Québec**, the course had to evolve.

The suitability of the content for the pupils and the realities of the learning situation influenced content selection. For example, the relationships between organs are considered to be more important than detailed knowledge of the organs themselves. It was considered important to develop an overall picture of the harmonious functioning of the body and to examine the resulting outcome of this — health.

As health may be a fragile possession, the course should stress the acquisition of attitudes aimed at respect for, and maintenance of, health.

This is a vital contribution to the development of the secondary school pupil. It should enable him:
(a) to understand that the physiological changes which he is undergoing are natural, and help him accept them more readily;
(b) to become aware of his responsibility for his own body;
(c) to make his own contribution in the area of public health.

### General Framework

### Values and Aims of School Education

In keeping with the statements in the Plan of Action, the Human Biology course seeks to integrate the overall values and objectives of school

(1) Québec, ministère de l'Éducation **The Schools of Québec, Policy Statement and Plan of Action**, 1979, p. 89

education and to... "transmit the accepted values... with vigour and enthusiasm."[1]

This course attempts principally, to foster such values as intellectual discipline, autonomy, critical thinking, responsible behavior, self-respect, respect for others, for life, for health... "the respect for the environment, prerequisite to the identification of a more humane world."[2]

**Relationship between the general objectives of THE SCHOOLS OF QUÉBEC and the objectives of the teaching of Biology.**

The consultation which followed the publication of the Green Paper showed a large measure of agreement on the need for a course in Human Biology as part of a pupil's general education.

Biology, is in fact, a field which can contribute particularly to the complete development of the adolescent – physical, intellectual and social.

Human Biology involves the study of the major systems of the human body. The concepts acquired help make the pupil conscious of his "self," his possibilities, his resources, and his limits. It can help "young people to develop according to their own talents and their own personal resources, to evolve into autonomous and creative individuals, and to prepare themselves for their role as citizens."[3]

Human Biology should encourage the use of the scientific method (or approach) through which intellectual discipline can foster the gradual "development of independent thought."[4]

Human Biology deals with information which can involve the pupil with contemporary Quebec issues. Adolescents, like their parents, are concerned with problems of health, pollution, etc. The general population has developed a growing interest in the biological discoveries that affect the well-being of man, as well as his way of life. Human Biology thus offers learning processes "conducive to integrating the acquisition of knowledge with personal experience."[5] It offers many opportunities to increase the "sense of individual and collective responsibility of young people."[6]

It enables "young people to pursue their general education and to orient themselves in life as individuals who are also members of a community."[7] by developing a... "critical attitude in the face of the various intellectual trends by which they are solicited."[8]

The objectives of human biology teaching are closely linked with the general objectives of **The Schools of Québec.**

**Details**

**Relationship with other natural science courses.**

The Human Biology course is intended to continue the introduction to science which began in elementary school and was continued in Secondary I.

**Elementary School Science**

The teaching of natural science in elementary school is aimed at the optimum and balanced development of the individual.

It also attempts to develop the pupil's awareness of his responsibilities toward his immediate milieu and his environment in general.

Through this program, the young person discovers different aspects of his surroundings, and how to live in harmony with nature.

**Secondary School Science**

Through the Secondary I Ecology course, the pupil acquires an overall view of life in its many forms, is stimulated to learn new methods of work, develops the desire to understand the causes of events, and a critical attitude toward consumption and development is encouraged.

Through the Secondary II or III Physical Science course, the pupil increases his knowledge of matter by a study of concrete phenomena in his immediate environment, and learns to apply this knowledge in everyday life. He is introduced to different experimental techniques and learns to organize his thinking. He becomes conscious of applications of science in everyday life, and

(1) Québec, ministère de l'Éducation **The Schools of Québec, Policy Statement and Plan of Action**, 1979, p. 34

(2) **The Schools of Québec**, p. 28

(3) Québec, ministère de l'Éducation, **The Schools of Québec, Policy Statement and Plan of Action**, 1979, p. 29

(4) Ibid, p. 31

(5) Québec, ministère de l'Éducation, **The Schools of Québec, Policy Statement and Plan of Action**, p. 31

(6) Ibid, p. 31

(7) Ibid, p. 29

(8) Ibid, p. 31

develops personal and social attitudes and habits which should prepare him to become a better citizen.

In Secondary III, the pupil investigates the functioning of his own body and becomes conscious that he is responsible for maintaining his own health and that he can contribute to the well-being of others.

**Relationship with the Program of Personal and Social Development**

The "Reproduction" module of the Human Biology course has a complementary relationship with the personal and social development program.

Without being a sex education course per se, it may be that, on the cognitive level, this program overlaps certain parts of the Personal and Social Development Program, or vice-versa. In any event, the school staff should discuss the two in order to avoid repetitions and to adopt a similar approach.

The anatomy, physiology, and hygiene of reproduction are largely covered in the Human Biology Course. The sex education section of the Personal and Social Development Course is mostly concerned with such complementary aspects of sexuality as: the role of feelings, psychological development, criteria for decision-making, roles linked to sexuality, responsibility for actions, life plan.

The biological dimensions of sexuality, as well as its psychological, cultural, and moral dimensions are closely linked to values to which the community, in particular parents, are very sensitive. The importance of the mind, respect for the individual, altruistic love, sense of responsibility, loyalty and justice in actions, and the moral principles common to western society are the main values on which courses such as biology and personal and social development are based.

It should not be necessary to add that in its simple and straightforward descriptions of the anatomy and physiology of the reproductive system, as well as in discussion that can develop in class about its psychological, affective, and moral aspects, biology should be presented with some delicacy and respect.

As it is vital that school activities be supported by positive parental participation, special care should be taken that the parents be adequately informed about the course, and that they have an opportunity to contribute to its implementation.

**Target Population**

In keeping with the general provisions of the Basis of Secondary School Organization of February, 1981, the course is intended for a target population of pupils of about 14-15 years of age. It is compulsory for all Secondary III pupils.

# 1. General Orientation of the Course

## 1.1 NEEDS

Since the Human Biology course is first of all a means of attaining the objectives of secondary education, it should contribute to general education by offering a series of concepts to acquire, skills to master, and attitudes to develop.

To be effective, the content must respond to the needs of the adolescents for whom the course is intended, and take into consideration the changing needs of society.

### 1.1.1 Needs of Adolescents

Adolescents have a large number of needs that are closely linked to their physiological and psychological development.

Any attempt to give a valid account of the characteristics of 14 and 15 year olds within the compass of a single course would either be too long, or be incomplete.

It may be sufficient to review certain commonly expressed needs and how the Human Biology course can help meet these.

#### Need for security

The development of physical, intellectual, and psychological maturity involves profound changes in the adolescent. The new problems created by rapid growth often create a state of anxiety.

To respond to the need for security, this course stresses concepts of physiology and of hygiene which will enable the pupil to understand and appreciate the changes which he is undergoing.

#### Need for identity

Conscious of the profound transformations that are taking place the adolescent feels the need to re-evaluate and re-define his or her self-image. In spite of a tendency to be part of a group of friends, and to conform to the standards of the group, the young person strives both for self-recognition as a unique individual and for recognition of this by others.

To respond to the need for identity the course will avoid any pointless "dissection" of the human being. Instead, anatomical structures and physiological phenomena will be presented in a more global way which will highlight the interrelations between them.

To help the adolescent develop a constructive self-image, the course encourages attitudes of acceptance, admiration, and respect for his or her body, life, and health.

#### Need for autonomy

The search for independence becomes a major concern in adolescence. The pupil wants to free himself from rules, to voice his opinions, and to make decisions about his own life – an inevitable source of criticism and conflict at home as well as at school.

To help the pupil deal with personal problems, the Human Biology course will offer many intellectual and practical skills related to the scientific method.

To encourage the pupil's individual and critical thinking, the course will present problems, notably in the domain of health, requiring analysis of information and a search for solutions.

### 1.1.2 Needs of society

Our society exists in an environment that is experiencing an increasingly technological evolution. In such a context, a citizen should be well-informed and his critical faculties developed if he is to assume an intelligent and responsible role.

More than in any other domain, health presupposes autonomous

and wise choices. Public health represents a major economic consideration, and is closely linked with society's growth potential.

Its maintenance requires the participation and support of all.

The priority of the Human Biology course should be to stimulate pupils to reflect systematically on the conditions necessary for health, and to encourage them to make a commitment to the improvement of this personal and community resource.

## 1.2 CHOICE OF CONTENT

### 1.2.1 Selection Criteria

If the variety of educational objectives and the wealth of biological knowledge are balanced against the age of the pupils concerned and the limits of the allocated time, the necessity of establishing criteria for the choice of the objectives of this course can easily be understood.

These selection criteria are derived from the aims and objectives of **The Schools of Québec** and from the needs of the pupils.

#### Equilibrium

To continue the adolescent's general education, the Human Biology course makes provision for knowledge acquisition, skills mastery, and attitude development.

The course should be demanding enough to present a challenge to the majority, yet easy enough to allow them to demonstrate their abilities.

#### Utility and relevance

The various elements of this course were selected because of their ability to help adolescents appreciate the physiological phenomena that affect them and to encourage them to assume responsibility for their own health.

The content focuses both on the study of the major biological functions and on the close relationships between the structures involved. Because of their relevance, priority has been given to the functions of nutrition and reproduction.

Since elementary school and particularly since their course in ecology, pupils have become more and more familiar with a method of work in which they can be active, serious inquirers. The Human Biology course should further develop this.

The skills which are developed are those likely to be of use in future science courses and in situations outside the sciences.

Emphasis is placed on the reading and interpretation of experimental procedures, systematic and thoughtful observations, accurate presentation of the results, and the ability to draw logical conclusions.

The attitudes to be developed are those that will endow the pupil with a sense of the complexity, the fragility, and the order that govern his or her body, and a feeling of concern, involvement, and responsibility for the maintenance of his or her health.

The course will attempt to develop the pupil's critical thinking through a variety of situations in which the basic rules of health can be deduced from biological knowledge.

#### Cohesion

While avoiding an overemphasis on terminology, the course does present a certain number of terms which will enable the pupil to communicate accurately.

The anatomical concepts selected are those that are necessary to the comprehension of the major physiological functions.

The physiological functions highlighted in this course are among

those that are most conducive to the involvement of the pupil in a concern for both life and health.

This course aims at the harmonious blending of knowledge, skills, and attitude as a means of contributing to the general education of the adolescent.

### 1.2.2 Structure and Guidelines of the Course

The Human Biology course presents the Secondary III pupil with three main themes:

— nutrition,
— relationships,
— reproduction.

## NUTRITION

To remain alive and active, a human being must consume food, transform it, transport it to each of his cells, metabolize it, and eliminate waste.

It is therefore logical to consider man as an organized biological system.

intake ——————————— products
(transformations)

By choosing nutrition as the first theme and emphasizing input (food, air) it is possible to:

(a) link man and the ecosystem through the most fundamental tie, the search for energy
(b) bring biology closer to the most frequently discussed current questions: energy, environment, famine, economy, pollution, nutrition, etc.
(c) lead the pupil to consider the close interrelationships existing between the different physiological activities of the body.
(d) suggest activities and attitudes that favor the maintenance of equilibrium.

The theme of nutrition is developed in six units that should require a minimum of 45 hours of teaching.

NUTRITION

Intake: food and air

Transformations and selection of intake
— digestion and absorption of food
— external respiration of oxygen
— hygiene of the respiratory and digestive systems

Transformations of selected intake
— circulation of the blood
— hygiene of the circulatory system

Metabolism of intake
— the cell
— the activities of the cell

Utilization of intake
— growth and repair

Elimination of waste
— elimination of carbon dioxide by the lungs
— elimination of urea by the kidneys

## RELATIONSHIPS

To live in harmony with and to control his environment, the human being must become knowledgeable about his environment, and interact with it.

This second theme encourages the pupil to view the sense organs as special avenues of contact with the environment.

It should lead him to consider his nervous system as a potent means of communication capable of constant improvement.

It also offers a study of the locomotor system as a means of locomotion and of interaction with the environment.

The Relationships theme is divided into two units, each one requiring a minimum of twelve hours of teaching.

COMMUNICATIONS

Sensory communications
— sense organs
— nervous system
— hygiene

Locomotor System
— the skeleton
— the muscles
— hygiene

## REPRODUCTION

This theme continues the study of communications: communication between humans which expresses the great biological force of conservation of the species.

In Secondary III, adolescents show a lively interest in questions related to sexual life.

— they readily accept the study of the anatomy and the physiology of the reproductive systems
— they are interested in choices and decisions concerning sexual activity

The theme of reproduction gives them facts about sexual functions, but also leads them to consider the responsibilities that arise from the exercise of sexuality.

Each of these two units should require a minimum of ten hours of teaching.

REPRODUCTION

Physiology of the reproductive system
— anatomy of the systems
— functions of the systems
— hygiene

Physiology of reproduction

## 2. Objectives

### 2.1 TERMINOLOGY OF THE OBJECTIVES

"The objectives may be grouped under the general heading of educational objectives. They then refer to all types of learning and to all aspects of personal development, whether on the cognitive, affective, socio-cultural, moral, religious, or psycho-motor planes."[1]

To ensure a measure of uniformity with the other courses and programs, the objectives will be classified using the following terms:

#### Overall Objective

The Overall Objective expresses the particular intent of the course and establishes a connection between the goals and the general objectives of the course. It gives the ultimate purpose of the course.

#### Goals

The goals are the anticipated middle range outcomes leading to the overall objective, and determine the role of the course or program. The goals relate to three areas: knowledge, skills, and attitudes.

#### General Objective

"A general objective can be defined as a comprehensive statement describing the aims of the instruction. Because of its comprehensive nature, this type of objective is not concerned with measuring a behavior or with emphasizing what the pupil should be able to do or to demonstrate after the learning activity."[2] Two kinds of objectives can be distinguished; the general objectives of the course (G.O.) and the general objectives of a module (G.O.M.).

**Example:** To develop the types of personal commitment necessary for the maintenance of health...

#### Terminal Objective

A terminal objective expresses in relatively specific terms the changes[3] anticipated in a pupil on the completion of an instructional sequence or of a specific period of instruction.

**Example:** To analyze the composition of a menu based on the qualitative and quantitative needs of typical adolescents...

#### Intermediate Objective

An intermediate objective expresses, in relatively specific terms, the changes anticipated in a pupil during his progress toward the achievement of a terminal objective.

**Example:** To develop a daily menu which meets the energy requirements of adolescents.

#### Related Content

The related content presents the focus of the pupil's activities. All the elements that can be logically related to the objectives involved may fall into this category — knowledge, skills, and techniques.

**Example:** To specify what should be done in the case of a fracture and a sprain.

**N.B.:**

1. Refer to the related content and the explanations found with the objectives when clarification is needed.
2. The lists are not intended to be exhaustive.
3. Part of the related content for Section 4.3 has been omitted, but will be included in the curriculum guide.

(1) Québec, ministère de l'Éducation, Direction générale du développement pédagogique. **Cadre relatif à l'élaboration des programmes et des guides pédagogiques**. 3rd version, April 1980, p. 14-16 F.T. (This citation is a free translation.)

(2) Nadeau, Marc-André. **Mesure et évaluation des objectifs pédagogiques**. Les Éditions St-Yves, Québec, 1975, p. 15. (This citation is a free translation.)

(3) The word "changes" is used here to describe any modification in a pupil's behavior related to a learning objective, whether of a cognitive, affective, social, psychomotor, or attitudinal nature.

## 2.2 FORMULATION CRITERIA

The drafting of an instructional objective involves:

(a) formulation in terms of the pupil. (The pupil will exhibit the changes desired.)
(b) use of an action verb to describe the expected behavior;
(c) a behavior;
(d) the outcome of the learning process.

As a general rule, other criteria (context and performance) have not been specified, leaving these to the initiative and judgement of the teacher.

Notes identifying the limits or range of application have been added for some of the intermediate objectives.

## 2.3 OVERALL OBJECTIVE OF THE COURSE

The role of this course is to induce pupils to make an effective and responsible contribution to their own physical and psychological well-being, as well as to that of others.

The Human Biology course offers the pupil:

— information related to the functioning of his own body, to health, to hygiene, and to sexuality;
— practical and intellectual skills inherent in science education, and useful outside the field of science;
— attitudes that may influence him to appreciate the complexity, fragility, and order that govern his body, to commit himself to the maintenance of his health, to contribute to the well-being of others, and to integrate the affective aspect of his sexuality.

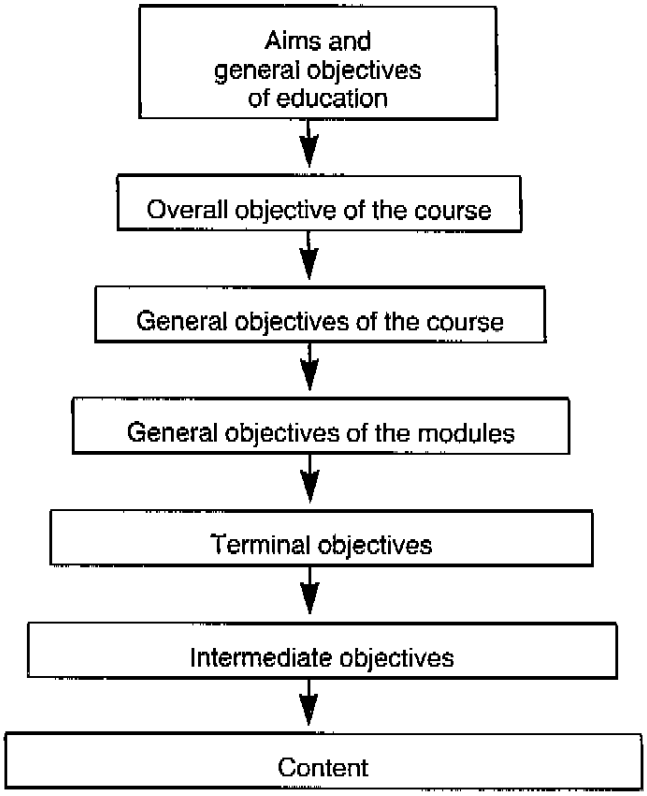
## 2.4 GENERAL OBJECTIVES OF THE COURSE

The pupil should be able:

— to develop the types of personal commitment necessary for the maintenance of health, based on the various aspects of nutrition and their interdependence;
— to recognize that the sense organs, the nervous system, and the locomotor system are different means of communicating with the environment;
— to develop knowledgeable attitudes regarding his or her sexuality, based on an understanding of the structure and function of the reproductive system.

## 3. Organization of the Objectives

### 3.1 HIERARCHY



## 3.2 COMPULSORY AND OPTIONAL OBJECTIVES

All the terminal and intermediate objectives are compulsory.

The systematic articulation of the themes, the criteria for the selection and structuring of the content, and the basic relationships between the terminal and intermediate objectives rule out an optional designation for any of the intermediate objectives.

The terminal objectives and the intermediate objectives together constitute the indispensable minimum for the attainment of both the general objectives of the modules and the general objectives of the course.

All the terminal and intermediate objectives should thus be considered as suitable for evaluation within the framework of a local measurement and evaluation plan.

The nature of the measurement instruments will determine the field of application of uniform measurement and evaluation.

On the other hand, the enrichment objectives in the curriculum guide are suggestions only, and thus are optional.

## 4. Content and Objectives of the Course

### 4.1 FUNCTION OF NUTRITION

**General Objective of the Module:**

**To develop** the types of personal commitment necessary for the maintenance of health, based on the study of the various aspects of nutrition and their interdependence.

#### 4.1.1 UNIT 1: Intake: Food and Air

**Terminal Objective of the Unit:**

**To analyze** the composition of a menu, based on the qualitative and quantitative needs of typical adolescents, and to describe the role of oxygen in nutrition.

##### 4.1.1.1 Role of Food

The pupil should be able:

**Terminal Objective:**

**To associate** the most commonly consumed foods with their roles in the body.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To name** the 3 main roles of food.<br><br>2. **To associate** common foods with each role. | (a) For building and repairing: proteins, water (meat, fish, cheese, nuts).<br>(b) As sources of energy: carbohydrates, (sugar, starchy foods), fats (butter), proteins.<br>(c) As regulators: vitamins, water, mineral salts, cellulose (fruits, vegetables, etc.). |

##### 4.1.1.2 Food Requirements

The pupil should be able:

**Terminal Objective:**

**To determine** the quantity and quality of food needed by adolescents based on the given information.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To evaluate** the quantitative needs of adolescents. | (a) in water<br>(b) in building foods<br>(c) in energy foods<br>(d) in regulating foods |

| | |
|---|---|
| 2. **To develop** a daily menu which meets the energy requirements of adolescents. | 1g of proteins = 16 kJ<br>1g of fats = 36 kJ<br>1g of carbohydrates = 16 kJ<br>Approximately 12 800 kJ |

#### 4.1.1.3 Air and Its Components

The pupil should be able:

**Terminal Objective:**

**To describe** the role of oxygen in nutrition.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To name** the three main components of air and their proportions. | Nitrogen (79%), oxygen (21%), carbon dioxide (Traces). |
| 2. **To determine**, experimentally, the percentage of oxygen in the air. | 21% |
| 3. **To determine**, experimentally, the role of oxygen in combustion. | Oxygen supports combustion. |
| 4. **To show** that the oxygen which entered the body supports combustion. | Glucose + oxygen ⟶ energy (heat) + carbon dioxide + water. |

### 4.1.2 UNIT II: Transformation and Selection of Intake

**Terminal Objective of the Unit:**

**To identify** the changes which occur in air and foods before certain of their components enter the blood.

#### 4.1.2.1 Anatomy of the Digestive System

**The pupil should be able:**

**Terminal Objective:**

**To locate** the main parts of the human digestive system on a diagram.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To name** and **locate** five parts of the digestive tract. | Mouth, esophagus, stomach, small intestine, large intestine. |
| 2. **To name** and **locate** five digestive glands. | Salivary glands, gastric glands, liver, pancreas, intestinal glands. |
| 3. **To indicate** the difference between the digestive tract and the digestive glands. | **Digestive tract:** site of digestion, transport, storage and absorption. |

| | |
|---|---|
| | **Glands:** secrete enzymes necessary for chemical digestion, and are found either within the digestive tract or attached to it. |

#### 4.1.2.2 Physiology of Digestion

The pupil should be able:

**Terminal Objective**

**To associate** the main stages of digestion with the breakdown of complex foods.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To describe** the mechanical phases of digestion. | **Mouth:** Chewing and swallowing<br>**Stomach:** mixing and storing.<br>**Intestine:** mixing and peristalsis. |
| 2. **To differentiate** experimentally a mechanical change from a chemical change. | **Mechanical:** foods are broken down into relatively large particles by physical means. The food still retains its original chemical composition.<br>**Chemical:** foods are further broken down into simpler chemical components. |
| 3. **To illustrate** the general role of digestion, using diagrams. | Decomposition of complex food molecules into simpler food molecules (Ex: proteins → amino acids). |
| 4. **To define** the process of absorption and **locate** where it occurs. | Absorption of simple food molecules into the blood through the small intestine. |
| 5. **To indicate** what happens to undigested foods. | Passage into the large intestine for storage and elimination. |

#### 4.1.2.3 Hygiene of the Digestive System

The pupil should be able:

**Terminal Objective**

**To list** some principles of hygiene relative to the digestive system and apply them to the maintenance of his health.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To indicate** three measures that are considered part of preventive dental hygiene. | (a) Diet rich in calcium and phosphorous.<br>(b) Regular brushing of the teeth.<br>(c) Regular visits to the dentist. |

| | |
|---|---|
| 2. **To name** the principal dental care policy. | April 1983<br>— Refer to the pamphlet "WE CARE" — Oral Surgery Program, Dental Services Program and Dental Prostheses. (Régie de l'Ass.-maladie du Qué.) |
| 3. **To identify** two preventive measures related to the hygiene of the large intestine. | (a) Diet rich in cellulose.<br>(b) Physical exercise. |

#### 4.1.2.4 Anatomy of the Respiratory System

The pupil should be able:

**Terminal Objective**

**To locate** the main structures of the human respiratory system on a diagram.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To name** and **locate** 5 parts of the respiratory system. | Nasal cavities, pharynx, trachea, bronchi, lungs. |
| 2. **To compare** the area of the alveoli with a surface of similar magnitude. | 200 $m^2$ of alveolar surface. |

#### 4.1.2.5 Physiology of the Respiratory System

The pupil should be able:

**Terminal Objective:**

**To associate** the entry of air into the lungs with its absorption into the blood.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To describe** the mechanism for the inspiration and expiration of air. | Role of the ribs and of the diaphragm. |
| 2. **To illustrate** by means of a diagram, the passage of oxygen from the alveoli to the blood vessels. | Diffusion. Permeability of the membranes. |

#### 4.1.2.6 Hygiene of the Respiratory System

The pupil should be able:

**Terminal Objective:**

**To identify** those factors which contribute to the proper functioning of the respiratory system.

provided that beforehand, he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To describe** the filtration system found and its limitations with respect to pollutants. | Filtration and heating: hair in the nostrils, mucus in the respiratory tract, cilia of the trachea and of the bronchial tubes. |
| 2. **Name** some effects of a current pollutant: tobacco. | (a) Lung cancer<br>(b) Chronic bronchitis<br>(c) Emphysema<br>(d) Cardiovascular diseases<br>(e) Decrease in life expectancy |
| 3. **To suggest** two ways of improving the air quality. | (a) Development of green spaces<br>(b) Reduction of atmospheric pollutants. |

### 4.1.3 UNIT III: Transportation of Selected Intakes

**Terminal Objective of the Unit:**

**To specify** the nature and the importance of the circulatory system.

#### 4.1.3.1 Anatomy of the Circulatory System

The pupil should be able:

**Terminal Objective:**

**To describe** the main organs of the circulatory system, and their function in blood circulation.

provided that beforehand, he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To name** the main components of the blood. | **Liquid:** the plasma.<br>**Elements involved:** red and white corpuscules, blood platelets. |
| 2. **To verify**, with the aid of a microscope, the existence of two of the three types of cells present in the blood. | Red corpuscules and white corpuscules (the blood platelets are difficult to observe). |
| 3. **To give** the function of each type of cell. | **Red corpuscules:** transportation<br>**White corpuscules:** defence<br>**Platelets:** coagulation. |
| 4. **To name** the main components of plasma. | Water and nutrients (glucose, amino-acids, salts). |
| 5. **To give** the functions of plasma. | (a) gives fluidity to the blood<br>(b) transports nutrients<br>(c) contains antibodies |
| 6. **To give** the origin of lymph. | Liquid: derived from the blood that left the blood vessels at the level of the capillaries. |
| 7. **To name** the main components of lymph. | Plasma and white corpuscules. |

| | |
|---|---|
| 8. **To describe** the functions of lymph. | (a) Transports nutrients at the cellular level.<br>(b) Collects cell waste. |
| 9. **To identify** the cavities of a mammalian heart, using a diagram. | Two atria<br>Two ventricles |
| 10. **To identify** the vessels connected to the heart, using a diagram. | Venae cavae, aorta, pulmonary veins, pulmonary arteries. |
| 11. **To identify** the pathways of blood circulation using a diagram. | Pulmonary circulation and systemic circulation. |
| 12. **To describe** the circulation of the blood through the capillaries. | Slow and regular flow of the red corpuscules, in single file, through the vessels. |

#### 4.1.3.2 Physiology of the Circulatory System

The pupil should be able:

**Terminal Objective:**

**To establish** a relationship between the circulatory system and some aspects of human physiology that affect his life.

provided that beforehand, he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To make** a chart comparing vaccine, antibody, and immunity, which illustrates their relationships. | **Vaccine:** dead or weakened antigens which stimulate the production of antibodies.<br>**Antibodies:** part of the defence system of the body, they help neutralize antigens for various lengths of time. |
| 2. **To describe** the importance of vaccination. | (a) **for oneself:** protection against certain diseases.<br>(b) **for others:** prevention of epidemics. |
| 3. **To give** two well-known examples of vaccinations. | Tuberculosis, polio, smallpox, measles, diphtheria. |
| 4. **To determine** his own blood type, experimentally. | Group A B AB or O<br>44% 8% 3% 45% |
| 5. **To define** blood transfusion. | Transfer of the blood of an individual called a donor to another individual called a recipient. |
| 6. **To solve** exercises involving transfusions and incompatible blood types. |  <br>($Rh^+$ or $Rh^-$) |
| 7. **To list** the factors that show the importance of capillary circulation. | (a) Links arteries and veins.<br>(b) Very closely knit network.<br>(c) Site of exchange between blood and cells.<br>(d) Site of diapedesis. |
| 8. **To list** the main materials exchanged between the capillaries and the cells. | (a) water<br>(b) nutrients<br>(c) oxygen<br>(d) waste |

#### 4.1.3.3 Cardiovascular Hygiene

The pupil should be able:

**Terminal Objective**

**To be aware** of certain cardiovascular problems and to suggest means of preventing them.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To list** the bad effects of lack of exercise, obesity and use of tobacco on the heart-beat rate. | **Lack of exercise:** reduces the strength of the heart and the elasticity of the arteries; interferes with the flow of the blood.<br>**Obesity:** atheroma (deposit of cholesterol on the internal walls of the arteries), coronary embolism.<br>**Use of tobacco:** exacerbates the dangers of poor nutrition. |
| 2. **To list** rules for a healthy heart. | (a) Regular physical exercise of gradually increasing intensity.<br>(b) Sound nutrition.<br>(c) Elimination of the use of tobacco. |
| 3. **To define** blood pressure. | Pressure of the blood within the arteries which is due to the contraction of the heart and of the elasticity of the arteries. |
| 4. **To measure** his blood pressure. | (a) systolic pressure.<br>(b) diastolic pressure. |
| 5. **To compare** his blood pressure to the normal range of blood pressure. | |
| 6. **To name** two dangers of hypertension (high blood pressure). | (a) Danger of rupture of the arteries followed by hemorrhage.<br>(b) Danger of fatigue of the cardiac muscle. |
| 7. **To give** two symptoms of hypotension (low blood pressure). | Dizziness, lack of energy. |

### 4.1.4 UNIT IV: Metabolism of the Intake

**Terminal Objective of the Unit:**

**To specify** the nature and the importance of cell activities.

#### 4.1.4.1 Cellular Structures

The pupil should be able:

**Terminal Objective:**

**To describe** cells and their relationship to the structures of a living organism.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To observe** some cells through a microscope. | (a) Use of the microscope.<br>(b) Human cells (mucous membrane).<br>Plant cells (onion).<br>Dead cells (cork). |
| 2. **To describe** the relative size of a cell. | Usually invisible to the naked eye. Smaller than a pin head but larger than a molecule. |
| 3. **To make** an evaluation of the approximate number of cells in the human body. | Volume of the body divided by the volume of a typical cell. |
| 4. **To observe** and identify three basic cell structures. | (a) Cell membrane.<br>(b) Cytoplasm.<br>(c) Nucleus. |
| 5. **To indicate** the main role of each of these structures. | Cell Membrane: exchange.<br>Cytoplasm: transportation.<br>Nucleus: control. |
| 6. **To list** the materials exchanged between the cell and its environment and name the processes involved. | Nutrients, waste, water, oxygen, osmosis, diffusion, pinocytosis. |
| 7. **To show** the universality of the cell in living organisms. | Examination of several types of cells: protozoan, animal, plant. |

#### 4.1.4.2 Cell Activities

The pupil should be able:

**Terminal Objective:**

**To describe** the importance of cellular respiration and specify its different stages.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To define** cellular respiration. | In the presence of oxygen the food transforms into energy, and eliminates carbon dioxide and urea. |
| 2. **To indicate** the role of oxygen in cellular respiration. | Oxygen is essential to the process of breaking down food in order to release energy from the food molecules (combustion). |
| 3. **To compare** the energy supplied by fats, carbohydrates, and proteins. | Fats: 36 kJ/gram.<br>Carbohydrates: 16 kJ/gram.<br>Proteins: 16 kJ/gram. |
| 4. **To name** the principal waste product of the:<br>(a) combustion of fats and carbohydrates;<br>(b) metabolism of proteins. | (a) Carbon dioxide<br>(b) Urea |

| | |
|---|---|
| 5. **To show** the importance of the elimination of waste. | Toxicity of these substances.<br>Detoxification of the organism. |

### 4.1.5 UNIT V: Utilization of Intake

**Terminal Objective of the Unit:**

**To describe** how the body makes use of these raw materials.

#### 4.1.5.1 Growth and Repair

The pupil should be able:

**Terminal Objective:**

**To illustrate** the relationship between the growth and repair of the body and the intake of food and air.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To identify** the main stages of human growth. | (a) Rapid during early childhood.<br>(b) Upsurge at the beginning of adolescence, followed by stabilization.<br>(c) Non-existent in adulthood. |
| 2. **To show** that growth is the result of cell division. | The proliferation of cells increases the volume and the mass of the body. |
| 3. **To name** three factors which promote growth. | (a) Intra-cellular controls (chromosomes or heredity).<br>(b) Action of certain glands (pituitary and thyroid).<br>(c) Quality of nutrition. |
| 4. **To list** situations that require body repair. | (a) Normal wear: blood, skin, bones, mucous membrane.<br>(b) Accidents: hemorrhage, fracture, cut, burn, sprain, dislocation. |
| 5. **To find**, with the help of a first aid manual, the treatment for four types of accidental injuries which would:<br>(a) encourage natural repair processes,<br>(b) avoid infection. | Setting, immobilization, disinfection, bandaging, tourniquet, pressure bandage, antibiotics, etc. |

#### 4.1.5.2 Utilization of Carbohydrates and Fats

The pupil should be able:

**Terminal Objective**

**To establish** the relationship between his food energy intake and his energy expenditure.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To make** a chart comparing the energy needed for:<br>(a) maintaining body temperature<br>(b) work | Relative inactivity or office work: 9 660 to 10 500 kJ<br>Sedentary manual work: 10 500 to 12 600 kJ<br>Work of moderate intensity: 12 600 kJ to 16 800 kJ<br>Hard labour: 16 800 to 21 000 kJ |
| 2. **To measure** body temperature using a thermometer. | Production of heat energy when at rest. Normal temperature: 37° C. |
| 3. **To calculate** the energy expenditure of an adolescent during different types of activity. | Walking (3,5 km) on a horizontal plane. 604 kJ<br>Walking (2,2 km) with a load of 5 kg, on a horizontal plane. 1 196 kJ<br>Ascending 30 m on a 30° slope. 607 kJ<br>Bicycling 4,5 km on flat ground 1 318 kJ<br>6,5 km 2 400 kJ<br>6,5 km with adverse wind 2 520 kJ<br>Playing hockey 4 200 kJ |
| 4. **To calculate** the energy value of the foods consumed by an adolescent in one day. | Reminder:<br>Energy value:<br>(a) Carbohydrates: 16 kJ/gram<br>(b) Proteins: 16 kJ/gram<br>(c) Fats: 36 kJ/gram |

#### 4.1.5.3 Balance Between Food Intake and Activities

The pupil should be able:

**Terminal Objective**

**To recognize** the importance of a balanced life style.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To evaluate** his diet and activities from the viewpoint of energy intake and expenditure. | Balance: Health<br>Surplus: overweight<br>Lack: growth problems |
| 2. **To make an inventory** of the resources in his immediate environment which favour:<br>(a) a balanced diet,<br>(b) physical activities. | In:<br>(a) the school;<br>(b) the family;<br>(c) the municipality;<br>(d) Communications: radio, T.V., newspapers. |

| | |
|---|---|
| 3. **To list** the advantages of choosing a balanced life style. | (a) Physical fitness<br>(b) Better organ function<br>(c) Proper functioning of the excretory organs<br>(d) Food economy<br>(e) Growth consistency. |

### 4.1.6 UNIT VI: Elimination of Waste

**Terminal Objective of the Unit:**

**To describe** the roles of the lungs and the kidneys in maintaining the constant composition of the blood.

#### 4.1.6.1 Elimination of Carbon Dioxide

The pupil should be able:

**Terminal Objective:**

**To recognize** the lungs as the most important organs for the elimination of carbon dioxide.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. Using an indicator, **to detect** the presence of carbon dioxide in:<br>(a) air which is to be inhaled.<br>(b) the vicinity of intense combustion.<br>(c) air which has been exhaled. | Internal or external combustion produces carbon dioxide as a waste product. |
| 2. **To compare**, using given information, the composition of inhaled and exhaled air. | Inhaled air: $N_2$, 79%, $O_2$, 21%, $CO_2$ traces.<br>Exhaled air: $N_2$, 79%, $O_2$, 16%, $CO_2$, 4,5%. |
| 3. **To trace**, on a chart, the path followed by carbon dioxide gas throughout the body. | Cell (production) ⟶ blood<br>(transportation) ⟶ lungs<br>(expulsion). |
| 4. **To measure** respiratory rhythm.<br>(a) at rest,<br>(b) after physical exercise. | The difference indicates an increased supply of oxygen is needed for combustion, and that an increased elimination of carbon dioxide waste occurs. |
| 5. **To establish** the relationship between cellular respiration, the level of carbon dioxide in the blood, and respiratory rhythm. | The more food the cell consumes to produce energy, the more carbon dioxide waste it produces. The latter increases in the blood and is expelled by the lungs at a rhythm proportional to its level in the blood. |
| 6. **To name** three means of diminishing a tendency to shortness of breath. | (a) Regular exercise.<br>(b) Elimination of excess weight.<br>(c) Elimination of smoking. |
| 7. **To state** two contributions of the lungs to the maintaining of constant blood composition. | (a) Oxygen enrichment.<br>(b) Elimination of carbon dioxide. |

### 4.1.6.2 Role of the Kidneys in the Elimination of Nitrogenous Wastes.

The pupil should be able:

**Terminal Objective**

To describe the renal excretory system, and to **associate** it with the elimination of nitrogenous wastes.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To name** four parts of the renal excretory system. | (a) Kidneys<br>(b) Ureters<br>(c) Bladder<br>(d) Urethra |
| 2. **To describe** the function of each of these parts. | (a) Kidneys: filter the blood and eliminate waste.<br>(b) Ureters: conduct urine from the kidneys to the bladder.<br>(c) Bladder: stores urine<br>(d) Urethra: conducts urine from the bladder to the exterior of the body. |
| 3. **To trace** on a diagram the path followed by nitrogenous waste. | (a) Released by the cells<br>(b) Carried by the blood<br>(c) Eliminated by the renal excretory system. |
| 4. **To list** the factors that cause variations in the quantity of urine. | (a) Quantity of water absorbed<br>(b) Quality of nutrition: mineral salts in particular<br>(c) Quantity of water eliminated through perspiration. |
| 5. **To name** three contributions of the kidneys towards the blood equilibrium. | (a) Regulate the quantity of water<br>(b) Regulate the quantity of mineral salts<br>(c) Remove nitrogenous wastes |

## 4.2 FUNCTION OF THE RELATIONSHIPS

**General Objective of the Module:**

**To recognize** that the sense organs, the nervous system, and the locomotor system are different means of communicating with the environment.

### 4.2.1 UNIT I: Sensory Relationships

**Terminal Objective of the Unit:**

**To show** the similarity in function among the sense organs, and the importance of preventive hygiene for the proper functioning of the nervous system.

#### 4.2.1.1 Environment: Source of Stimuli

The pupil should be able:

**Terminal Objective:**

**To identify** external sources of stimuli and associate them with receptor organs.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To make** a list of the types of stimuli that can be provided. | (a) light and color: eye<br>(b) sound: ear<br>(c) odour: nose<br>(d) flavour: tongue<br>(e) hot and cold: tongue, skin<br>(f) pressure on the skin<br>(g) pain: generalized |
| 2. **To associate** each of the stimuli with a receptor organ. | |

#### 4.2.1.2 Anatomy of the Eye

The pupil should be able:

**Terminal Objective:**

**To describe** the anatomical structures of the eye.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To draw and label** a diagram of a cross section of the eye. | Membrane: sclerotic<br>choroid<br>retina<br><br>Transparent areas: vitreous humour<br>aqueous humour<br>crystalline lens |

| | |
|---|---|
| 2. **To list** the differences between the transparent areas and the membranes of the eye. | Transparent areas: clear in the center of the eye...<br>Membranes: on the periphery, opaque (except for the cornea) |
| 3. **To list** the roles:<br>(a) of each of the membranes<br>(b) of all the transparent areas. | Sclerotic: rigid, gives the eye its shape.<br>Choroid: provides nourishment to the eye.<br>Retina: active nervous membrane.<br>Transparent areas: system of lenses and of the conduction of light waves. |

#### 4.2.1.3 Physiology of the Eye

The pupil should be able:

**Terminal Objective:**

**To describe** the passage of light, its transformation into nerve impulses in the eye, and the transmission of these impulses to the cerebrum.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To trace**, the path followed by light rays to the receptor, the retina, using a diagram of the eye. | Function of the crystalline lens and the transparent humors. |
| 2. **To state** the characteristics of the nerve cells that compose the retina. | (a) specialized<br>(b) excitable<br>(c) capable of generating and conducting a nerve impulse. |
| 3. **To describe** the structure of the optic nerve. | Nerve tissue formed by the axons of retinal cells. |
| 4. **To describe** the role of the optic nerve in the transmission of nerve impulses. | Transmits nerve impulses from the retina to the brain. |
| 5. **To locate** the cerebrum on a diagram of the brain. | Excluding the other components of the brain. |
| 6. **To locate**, on a diagram of the cerebrum, the optic area, the center of vision. | In relation to the other areas of the cerebrum. |

#### 4.2.1.4 Hygiene of the Eye

The pupil should be able:

**Terminal Objective**

**To realize** the importance both of good vision and of the correction of any visual abnormalities.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To measure** his own visual acuity, with the help of a chart. | Understanding the terms 10/20, 20/20, 8/20 etc. |
| 2. **To give** the causes and the effects of:<br>(a) myopia,<br>(b) hyperopia. | Myopia: the image is focused in front of the retina therefore distant objects are blurred.<br>Hyperopia: the image is focused behind the retina, therefore close objects are blurred. |
| 3. **To distinguish** between hyperopia and presbyopia. | (a) Effects are identical<br>(b) Causes are different<br>Hyperopia: flattened eyeball<br>Presbyopia: age, faculty of adaptation diminished. |
| 4. **To describe** the corrections effected by the use of eyeglasses or of contact lenses. | Myopia: concave lenses<br>Hyperopia and presbyopia: convex lenses. |
| 5. **To name** some rules for reducing eye strain. | (a) Sufficient light<br>(b) Suitable distance for reading: 20 to 30 centimeters<br>(c) Allow the eye to rest by occasionally changing the focal distance being used. |

#### 4.2.1.5 Anatomy and Physiology of the Ear

The pupil should be able:

**Terminal Objective**

**To describe** the passage of sound waves, their transformation into nerve impulses in the ear, and the transmission of these impulses to the cerebrum.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To locate**, on a diagram the external ear, the middle ear, and the inner ear. | **External** (external to the cranium): pinna, and auditory canal.<br>**Middle** (small cavity in the temporal bone): eardrum, ossicles, Eustachian tube.<br>**Inner** (cavity in the petrous portion of the temporal bone): labyrinth and cochlea. |
| 2. **To list** in order the structures involved in the transmission of sound. | Pinna → auditory canal → eardrum → ossicles → cochlea → auditory nerve → auditory area of the brain. |
| 3. **To identify** and **locate** the receptor, the transmitter, and the interpreter involved in hearing. | **Receptor:** ear<br>**Transmitter:** auditory nerve<br>**Interpreter:** auditory area of the brain. |

#### 4.2.1.6 Hygiene of the Ear

The pupil should be able:

| **Terminal Objective** |
|---|
| **To explain** the main causes of diminished hearing acuity, and give ways of avoiding them. |

providing that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To name** three possible causes of diminished hearing acuity. | (a) Partial or complete obstruction of the auditory canal by wax.<br>(b) Rupture of the eardrum.<br>(c) Loss of sensitivity of mechanical structures (eardrum, ossicles). |
| 2. **To relate** rules of hygiene to the above mentioned causes. | (a) Have wax removed.<br>(b) Avoid high-pitched and piercing sounds, and undersea diving with blocked Eustachian tubes.<br>(c) Avoid loud and prolonged sounds: industries, discotheques, etc. |

#### 4.2.1.7 Anatomy and Physiology of the Skin

The pupil should be able:

| **Terminal Objective** |
|---|
| **To describe** the skin as a receptor organ for stimuli. |

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To locate** on a diagram of a cross section three main layers of the skin. | (a) Epidermis<br>(b) Dermis<br>(c) Subcutaneous layer |
| 2. **To name** the main sensations perceived by the receptors in the skin. | (a) Tactile sensations<br>(b) Painful sensations<br>(c) Thermal sensations |
| 3. **To associate** different skin structures with each of these sensations. | i.e. Corpuscles and free nerve endings. |
| 4. **To show** experimentally that the distribution of sensitive points is uneven. | **Tactile acuity** about 500 000 points of touch, separated by 2 to 70 mm according to location.<br>**Thermal:** 20 000 hot spots 250 000 cold spots. It is the difference in temperature that is perceived.<br>**Pain:** about 170 spots per $cm^2$, especially the free nerve endings. |

| | |
|---|---|
| 5. **To name** each of the structures which has the role of receptor, transmitter, or interpreter of touch. | (a) Skin (free nerve endings and corpuscles)<br>(b) Sensory nerves, spinal cord<br>(c) Cerebrum |
| 6. **To name** three non-sensory roles of the skin. | (a) Protection<br>(b) Excretion<br>(c) Manufacture of Vitamin D |

#### 4.2.1.8 Hygiene of the Skin

The pupil should be able:

**Terminal Objective**

**To explain** the importance of skin hygiene and describe how it can be maintained.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To name** three advantages of having a clean skin. | (a) Improved functioning of the skin.<br>(b) Personal well-being<br>(c) Well-being of others |
| 2. **To name** two ways of avoiding sunburn. | (a) Gradually increasing the time of exposure<br>(b) Protection by appropriate sunscreening and blocking preparations. |
| 3. **To make** a list of some rules of hygiene relating to acne. | (a) Washing 3 times a day<br>(b) Keeping hands away from the face<br>(c) Avoiding ill-treatment of the skin<br>(d) Avoiding the use of skin treatment and cleansing preparations rich in oil.<br>(e) Practicing good nutrition |

#### 4.2.1.9 Taste and Smell

The pupil should be able:

**Terminal Objective**

To describe the organs of taste and smell, and **explain** their functional relationship.

provided that beforehand, he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To locate** and indicate the functioning of:<br>(a) the olfactory receptors, | (a) **Olfactory receptors:** superior part of the nasal cavities. Stimulated by odoriferous gaseous substances. |
| (b) the taste buds. | (b) **Taste buds:** on the tongue. Stimulated by substances in solution. |
| 2. **To enumerate** the conditions necessary for perception:<br>(a) of odours, | (a) **Odour:** gaseous, chemical, odoriferous molecules. Air carries the molecules to the olfactory receptors. |

| | |
|---|---|
| (b) of flavours. | (b) **Flavour:** soluble chemical molecules having a flavour coming into contact with the tastebuds. |
| 3. **To describe** the relationship which exists between taste and smell. | A blocked nose diminishes the sense of taste. Mint has no taste, but produces a sensation of flavor due to its strong odour. |
| 4. **To name** each of the structures which has the role of receptor, transmitter, or interpreter. | **Smell:**<br>Receptor: nose (olfactory receptor cells)<br>Transmitter: olfactory nerve<br>Interpreter: olfactory area of the cerebrum.<br>**Taste:**<br>Receptor: tongue (taste buds)<br>Transmitter: nerve fibres originating from taste buds<br>Interpreter: gustatory area of the cerebrum. |
| 5. **To state** two rules of hygiene which may help to preserve these two senses. | **Smell:** maintenance of open air passages and proper humidity of the mucous membranes.<br>**Taste:** strong flavours (pepper, spices, salt), alcohol, and tobacco lessen the sensitivity of taste. |

#### 4.2.1.10 Nervous System

The pupil should be able:

**Terminal Objective**

To understand and be able **to explain** various aspects of the functioning of the central nervous system.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To recognize** the main parts of the central nervous system. | Brain: (a) cerebrum<br>(b) brain stem<br>(c) cerebellum |
| 2. **To identify** the structures that transmit impulses. | Spinal cord<br>Nerves |
| 3. **To list** two functions of the brain. | (a) Detection and processing of information coming from outside the body (sensitivity) and from inside the body (equilibrium, coordination).<br>(b) Control of voluntary movements. |
| 4. **To indicate** the role played by the central nervous system in:<br>(a) thought processes<br>(b) reflexes | (a) **Thought processes:** located throughout the cerebrum. Note importance of the prefrontal area.<br>(b) **Reflexes:** occur at the level of the spinal cord, (fixed, automatic responses). |

| | |
|---|---|
| 5. **To indicate** two means of improving intellectual performance. | (a) Stimulating environment.<br>(b) Balanced life-style (nutrition, exercise, rest). |
| 6. **To list** the reasons why damage caused to nerve cells either by accident or through drug abuse is permanent. | (a) The nerve cell does not regenerate itself.<br>(b) The transmission of impulses may diminish or stop.<br>(c) The interpretation of the impulse may be distorted, interrupted, or only partially completed. |

### 4.2.2 UNIT II: Locomotor System

**Terminal Objective of the Unit:**

**To show** that the structural organization of the muscles and of the bones permits locomotor movement.

#### 4.2.2.1 General Structure

The pupil should be able:

**Terminal Objective**

**To outline** the advantages of the various structures of the human body.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To locate** the three anatomical regions of the body. | (a) Head<br>(b) Trunk<br>(c) Limbs |
| 2. **To state** some advantages of being able to stand upright. | (a) Head in an elevated position.<br>(b) Forelimbs free for uses other than locomotion. |

#### 4.2.2.2 Skeleton

The pupil should be able:

**Terminal Objective:**

**To describe** the function of the skeleton in supporting the soft organs and movements of the body.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To identify** the two component parts of the head. | (a) Cranium<br>(b) Face |
| 2. **To describe** the shape of the cranial bones, their arrangement, and the way they are joined together. | Flat bones, dome-shaped, and joined together in such a way that in adulthood they are immovable. |

| | |
|---|---|
| 3. **To give** the function of the cranium. | Protection of the brain. |
| 4. **To describe** the composition of the thorax and the arrangement of the ribs. | (a) Thoracic vertebrae, ribs and sternum<br>(b) The ribs form a dome supported by the sternum and have limited up and down mobility. |
| 5. **To describe** the role of the ribs in the exchange of gases. | Change volume of the thorax. |
| 6. **To make** a diagram of the vertebral column showing the curvature, the number of vertebrae, and the way they are linked. | Double curvature<br>33 vertebrae (32 to 34)<br>Articular cartilage allowing limited movement. |
| 7. **To relate** the structures of the vertebral column to its mobility and resistance. | Flexibility (double curvature), mobility (a great many elements), resistance to shocks (double curvature and discs of cartilage). |
| 8. **To describe** using a model, the alignment of the first two vertebrae. | Inclination and rotation around an axis. |
| 9. **To connect** the types of joints found in the limbs of the body with the kinds of movement they allow. | Rotation and extension. |
| 10. **To compare** the skeletal structure of an upper limb with that of a lower limb. | Each has a girdle<br>3 main articulations<br>Carpals and tarsals<br>Fingers and toes |
| 11. **To describe** the role of the ligaments in a joint. | Join the bones together and allow freedom of movement. |
| 12. **To identify** the marrow, the growth cartilage, and the periosteum of a fresh, young bone. | Red marrow, yellow marrow, growth cartilage between the epiphyses and the diaphysis. |
| 13. **To enumerate** the functions of the marrow, of the growth cartilage, and of the periosteum. | **Periosteum:** thin, external covering of the bone.<br>**Red marrow:** formation of the red corpuscules<br>**Periosteum:** growth in width<br>**Growth Cartilage:** growth in length |
| 14. **To list** the differences between a **fracture**, a **sprain**, and a **dislocation**. | **Fracture:** broken bone, shortened limb, internal cracking sound.<br>**Sprain:** abnormal displacement of an articulation, with immediate resetting, often accompanied by tearing of the ligaments.<br>**Dislocation:** Displacement of the articulatory surfaces, with straining and/or tearing of the ligaments. No cracking sound. |
| 15. **To explain** with the help of a first aid manual, how to treat these three injuries. | **Fracture:** setting, immobilization.<br>**Dislocation:** resetting, immobilization.<br>**Sprain:** immobilization. |
| 16. **To list** the conditions necessary for the normal development of the skeleton. | (a) Diet rich in calcium and phosphorous.<br>(b) Adequate supply of vitamins A and D.<br>(c) Normal functioning of the following endocrine glands: thyroid, pituitary, thymus. |

#### 4.2.2.3 Muscles

The pupil should be able:

**Terminal Objective:**

**To associate** the structure and the functioning of the muscles with movement.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To locate**, experimentally, the muscles responsible for:<br>(a) flexion of the forearm<br>(b) abduction of the arm. | (a) Biceps brachii<br>(b) Deltoid |
| 2. **Name** the visible changes that occur when muscles contract. | (a) They become shorter<br>(b) They increase in volume |
| 3. **To identify** the different parts of a muscle. | (a) Tendon<br>(b) Belly<br>(c) Aponeurosis |
| 4. **To show**, with the help of a diagram or a model, that muscular contraction produces movement. | Contraction produces movement of the bones which in turn leads to movement of the other structures. Active factor of movement. |
| 5. **The show** that the attachment of the muscle to the bone is essential. | If there is no attachment the muscle works in a vacuum without making the bone move. |
| 6. **To show** the antagonistic effect of the biceps and of the triceps, using a diagram or model. | Flexor and extensor. |
| 7. **To list** and describe the stimuli which cause muscles to react. | Stimuli: — Nature:<br>(a) Electricity — Physical<br>(b) Physical shocks — Physical<br>(c) Acids, bases, and salts — Chemical<br>(d) Nerve impulses — Physiological |
| 8. **To trace**, on a diagram, the path followed by a nerve impulse during a voluntary act. | Cerebrum ⟶ spinal cord ⟶ motor nerve ⟶ muscle |
| 9. **To define** muscular elasticity. | Property of a muscle which enables it to return to its initial length after contraction. |
| 10. **To name** two causes of muscular fatigue. | (a) Insufficient supply of energy and oxygen.<br>(b) Accumulation of waste. |
| 11. **To name** 4 ways of increasing resistance to muscular fatigue. | (a) Regular graduated exercises.<br>(b) Relaxation<br>(c) Good nutrition<br>(d) Adequate ventilation |

## 4.3 FUNCTION OF REPRODUCTION

**General Objective of the Module:**

**To develop** informed attitudes regarding his or her sexuality, based on knowledge of the structure and function of the reproductive system.

### 4.3.1 UNIT I: Anatomy and Physiology of the Reproductive System

**Terminal Objective of the Unit**

**To explain** the anatomy and physiology of the male and female reproductive systems.

#### 4.3.1.1 Anatomy of the Female Reproductive System

The pupil should be able:

**Terminal Objective**

**To identify** those parts of the female anatomy which belong to the reproductive system.

provided that beforehand, he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To identify**, using a diagram. of the female reproductive system, its main component parts. | **Vulva:** external genital orifice, mid-pelvic region.<br>**Vagina:** copulatory organ, internal, posterior to the bladder and urethra. |
| 2. **To locate**, on a cut-away or a diagram of the female anatomy, the main structures of the reproductive system. | **Uterus:** embryonic development, inside the pelvic cavity. |
| 3. **To state** the roles of the main structures of the female reproductive system. | **Fallopian Tubes:** Collect and transport the ovum, originate from opposite sides of the uterus.<br>**Ovaries:** Structures located at the ends of the Fallopian Tubes (that produce ova). |

#### 4.3.1.2 The Adolescent and Puberty

The pupil should be able:

**Terminal Objective**

**To understand** the role of hormones in the onset of puberty, and **to view** this as a physiological stage in the development of the adolescent.

provided that beforehand, he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To identify**, using a diagram, the glands belonging to the female reproductive system. | Endocrine glands:<br>(a) pituitary gland<br>(b) ovaries |
| 2. **To define** hormones. | Chemical substances secreted into the blood in small quantities by the endocrine glands, and transported through the body to target organs. |
| 3. **To name** the pituitary hormones. | FSH and LH (Follicle Stimulating Hormone and Luteinizing Hormone). |
| 4. **To name** the ovarian hormones. | Estrogen and progesterone |
| 5. **To define** puberty. | All the physiological and psychological changes that occur when a young person passes from childhood to adolescence. |
| 6. **To describe** the role of the sex hormones in the onset of puberty. | Effects on the whole body; and in particular, on the beginning of the menstrual cycle. |
| 7. **To list** the changes that appear in the adolescent girl at the time of puberty. | (a) Development of the breasts<br>(b) Development of pubic and axillary hair.<br>(c) Development of the figure in general.<br>(d) Physical transformation of the genitals, and beginning of the menstrual cycle. |

#### 4.3.1.3 Menstrual Cycle

The pupil should be able:

**Terminal Objective:**

**To identify** the phases of a 28 day menstrual cycle, and show the importance of hormones to this cycle.

provided that beforehand he or she is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To name** the changes that occur during the menstrual cycle. | (a) Development of the uterine mucosa<br>(b) Ovulation<br>(c) Desquamation of the uterine mucosa: menstruation |
| 2. **To describe** the action of ovarian hormones within the cycle. | (a) Phase 1: increased level of estrogen which leads to the start of ovulation.<br>(b) Phase 2: increased level of progesterone which causes the mucosa to thicken.<br>(c) Decreased level of estrogen and of progesterone induce menstruation. |
| 3. **To specify** the time of ovulation. | At the time when the level of estrogen is at its highest. |

| | |
|---|---|
| 4. **To give** two clues by which the time of ovulation can be identified. | (a) Slight rise in temperature.<br>(b) Mild pain in the abdomen. |
| 5. **To describe** the significance of ovulation. | (a) Ultimate reason for the menstrual cycle<br>(b) Renders the woman fertile |
| 6. **To give** the main characteristics of the ovum. | Ovum:<br>(a) Chromosome Number<br>(b) Size<br>(c) Survival |

#### 4.3.1.4 Feminine Hygiene

The pupil should be able:

**Terminal Objective:**

**To give** the general rules of feminine hygiene during and between menstrual periods.

provided that beforehand, he or she is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To identify**, using a diagram, the external female genitalia. | Vulva: (a) Labia majora<br>(b) Labia minora<br>(c) Clitoris<br>(d) Bartholin's Gland<br>(e) Hymen |
| 2. **To indicate** the role of Bartholin's Glands. | Secretion of a lubricating substance. |
| 3. **To establish** a few rules of personal hygiene pertaining to the female genitalia. | Removal of secretions:<br>Cleanliness of the external organs;<br>Daily washing. |
| 4. **To recognize** the possibility of pain at the time of menstruation. | Mild sensation of depression, headaches and backaches, mild cramps and abdominal heaviness. |
| 5. **To specify** the role of physical exercise at the time of menstruation. | Relieves tension, alleviates symptoms. |
| 6. **To state** the importance of the cleanliness of the skin at the time of menstruation. | (a) Health<br>(b) Personal well-being<br>(c) Well-being of others<br>(Taking a bath, a shower or swimming are not harmful.) |

#### 4.3.1.5 Anatomy of the Male Reproductive System

The pupil should be able:

**Terminal Objective:**

**To identify** those parts of the male anatomy that belong to the reproductive system.

provided that beforehand, he or she is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To identify**, using a diagram of the male reproductive system, its main component parts. | **Penis:** External copulatory organ.<br>Vas deferens: Collect and transport sperm. |
| 2. **To locate**, on a cut-away or diagram of the male anatomy, the main structures of the reproductive system. | **Prostate gland:** produces accessory secretions, located around the urethra beneath the bladder. |
| 3. **To state** the roles of the main structures of the male reproductive system. | **Seminal vesicles:** produce accessory secretions, located on each vas deferens near the prostate.<br>**Cowper's Gland:** produces accessory secretions, located on the pathway of the vas deferens.<br>**Testes:** produce sperm, external structures enclosed by the scrotum. |

#### 4.3.1.6 Puberty and the Adolescent

The pupil should be able:

**Terminal Objective:**

To understand the role of hormones in the onset of puberty, and **to view** this as a physiological stage in the development of the adolescent.

provided that beforehand, he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To identify**, using a diagram, the glands belonging to the male reproductive system. | Endocrine glands:<br>Pituitary<br>Testes |
| 2. **To name** the sex hormones secreted by the testes. | Androgens and testosterone |
| 3. **To differentiate** between the action of the pituitary hormones in men and women. | Continuous action of the pituitary hormones in men, cyclic in women. |
| 4. **To list** the changes that occur in an adolescent boy at the time of puberty. | (a) Change in the voice<br>(b) Growth of pubic and axillary hair<br>(c) Development of the figure in general<br>(d) Physical transformation of the genitals and the beginning of the production of sperm cells. |

#### 4.3.1.7 Physiology of the Male Reproductive System

The pupil should be able:

**Terminal Objective:**

**To describe** the structure of the sperm and the process of ejaculation.

provided that beforehand he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To describe** the main characteristics of sperm cells. | Sperm cells:<br>(a) Number<br>(b) Chromosome number<br>(c) Size<br>(d) Survival |
| 2. **To describe** the components of the semen. | Sperm and secretions of the seminal vesicles, prostate, Cowper's glands. |
| 3. **To trace**, on a diagram, the paths followed by semen and by urine. | Semen: testes, vas defenrens<br>Urethra sperm<br>Urine: bladder, urethra<br>(presence of sphincters) |
| 4. **To describe** the nature and importance of erection. | Accumulation of blood in the sinuses of the erectile tissue under the influence of the nervous system. Allows the organ to achieve sufficient firmness to ensure sexual relations. |
| 5. **To distinguish** between erection and ejaculation. | Erection is not always accompanied by ejaculation, which is the spasmodic ejection of the semen. |

#### 4.3.1.8 Male Hygiene

The pupil should be able:

| **Terminal Objective:** |
|---|
| **To state** the general rules of hygiene of the male genitalia. |

provided that beforehand, he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To define** circumcision. | Removal of the prepuce |
| 2. **To specify** cases that necessitate circumcision. | (a) narrow prepuce<br>(b) Hygiene<br>(c) Religious rite |
| 3. **To define** smegma | Sebaceous secretion that collects at the base of the glans. |
| 4. **To establish** a few rules of personal hygiene relative to the male genitalia. | Removal of smegma.<br>Cleanliness of the scrotum and penis.<br>Daily washing. |
| 5. **To state** the advantages of cleanliness of the genitalia. | (a) Health<br>(b) Personal well-being<br>(c) Well-being of others |

### 4.3.2 UNIT II: Physiology of Procreation

**Terminal Objective of the Unit:**

**To acquire** a knowledge of the physiology of procreation that will encourage intelligent sexual behavior.

#### 4.3.2.1 Sexual Relations

The pupil should be able:

**Terminal Objective**

**To establish** a difference between the biological function of reproduction of the species and the function of sexual relations between two human beings.

provided that beforehand, he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To define** sexual intercourse. | Technically, coitus is the introduction of the penis into the vagina, usually preceded by foreplay. |
| 2. **To define** sexual relations. | Intimate bond uniting two persons in sexual intercourse for the purpose of procreation and/or the mutual expression of love. |
| 3. **To state** the conditions necessary to human sexual relations. | (a) Mutual love<br>(b) Full mutual acceptance<br>(c) Physical and psychological security<br>(d) Sense of responsibility |

#### 4.3.2.2 Fertilization: possible physiological consequence of sexual intercourse.

The pupil should be able:

**Terminal Objective:**

**To recognize** fertilization as a possible physiological consequence of sexual intercourse.

provided that beforehand, he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To identify** the place and the time at which the sperm and the ovum meet. | 1/3 of the way down the Fallopian tubes, usually between the 12th and 24th hour after ovulation. |
| 2. **To define** fertilization. | Union of the male and female gametes resulting in the formation of a zygote, and ultimately of a child. |
| 3. **To identify** the rights and the needs of a child at birth. | (a) Life<br>(b) Love<br>(c) Security<br>(d) Responsible parental care<br>(e) Family environment |

#### 4.3.2.3 Pregnancy, Normal Consequence of Fertilization

The pupil should be able:

**Terminal Objective:**

**To establish** the relationship between the development of the embryo and the progress of the pregnancy.

provided that beforehand, he or she is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To distinguish** between the zygote, the embryo, and the fetus. | Different terms illustrating the uterine development of the child in the time and in size. |
| 2. **To explain** growth as a function of the division and specialization of cells. | Mitosis as a means of cellular growth. Specialization: increasing interdependence and efficiency. |
| 3. **To recognize** cessation of menstruation as one of the first signs of pregnancy. | Persistence of corpus luteum.<br>Implantation of the egg. |
| 4. **To describe** the basis of the pregnancy test. | Surplus of hormones present in the mother's urine.<br>These hormones, when injected, cause changes in the genitalia of female laboratory animals. |
| 5. **To indicate** the role of the following structures:<br>(a) Placenta<br>(b) Umbilical cord<br>(c) Amniotic fluid | **Placenta:** membrane uniting the embryo to the mother. Ensures exchanges between the two.<br>**Umbilical cord:** structure joining the embryo to the placenta. Cut at birth, the scar forms the navel.<br>**Amniotic fluid:** liquid surrounding the embryo. |
| 6. **To compare** fraternal twins and identical twins, on a basis of their origin and their resemblance. | Fraternal twins: two ova, two sperms, little resemblance.<br>Identical twins: one ovum and one sperm only, a great deal of resemblance. |
| 7. **To indicate** precautions to be taken during pregnancy. | Proper nutrition.<br>Adequate physical exercise.<br>Avoidance of tobacco, alcohol, self-medication, and drug abuse.<br>Sufficient sleep.<br>Healthy environment. |

#### 4.3.2.4 Birth

The pupil should be able:

**Terminal Objective:**

**To describe** the process of birth and the first moments of the baby's life.

provided that beforehand, he is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To state** two early signs of labor. | (a) Uterine contractions<br>(b) Blood-streaked discharge of loss of amniotic fluid. |
| 2. **To distinguish** between natural birth, cesarean section, and induced labor. | (a) **Natural birth:** with the active participation of the mother, no anaesthetic<br>(b) **Cesarean section:** under anaesthetic by opening the abdominal cavity and the uterus.<br>(c) **Induced labor:** stimulated by the injection of a hormone. |
| 3. **To name** four stages of labor. | (a) Dilation of the cervix<br>(b) Entrance of the fetus into the vagina.<br>(c) Birth of the baby.<br>(d) Expulsion of the placenta |
| 4. **To list** the rules of hygiene applicable to a new-born baby. | (a) Clean the nostrils and mouth<br>(b) Cut, tie and disinfect the umbilical cord.<br>(c) Facilitate the first breaths: slaps on the behind or on the soles of the feet.<br>(d) Lukewarm water bath<br>(e) Heat, dim light, quiet<br>(f) Breast feeding if possible |
| 5. **To identify** the sources of regional aid offered to future parents and to parents during the pre- and post-natal periods. | Varies according to the region: inquire. |

#### 4.3.2.5 Possible Pathological Consequences of Sexual Intercourse

The pupil should be able:

**Terminal Objective:**

**To specify** the knowledge and behaviours required in relation to sexually transmitted diseases.

provided that beforehand, he or she is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To name** two of the most widespread sexually transmitted diseases. | (a) Gonorrhea<br>(b) Syphilis |
| 2. **To identify** the main symptoms of a sexually transmitted disease. | (a) Gonorrhea:<br>(1) Woman: Vaginal discharge of a greenish color. Irritation of the vulva. (80% asymptomatic).<br>(2) Man: Painful micturition<br>Discharge of pus through the urethra. (20% asymptomatic). |

| | |
|---|---|
| | (b) Syphilis: Chancre<br>Skin outbreak<br>Heart attack<br>Blindness<br>Insanity<br>Death |
| 3. **Identify** means of preventing S.T.D. | (a) Abstention from sexual intercourse.<br>(b) Condoms<br>(c) Germicidal vaginal foam<br>(d) Washing of the genitalia with a bactericidal soap |
| 4. In the case of contracting S.T.D. **list** the reasons for early consultation of a doctor. | (a) Accurate diagnosis<br>(b) Serious consequences of the diseases<br>(c) Very contagious<br>(d) Easier to cure<br>(e) Simpler treatment |
| 5. **To give** the reasons why the partner should be informed in cases of S.T.D. | (a) Fairness<br>(b) Social responsibility<br>(c) Highly contagious diseases<br>(d) Prevention of an epidemic |

#### 4.3.2.6 Prevention of Fertilization

The pupil should be able:

**Terminal Objective:**

**To list** the principal methods of birth control, and **to describe** his or her responsibilities regarding these methods.

provided that beforehand, he or she is able:

| Intermediate Objectives | Related Content |
|---|---|
| 1. **To list** some methods of birth control. | (a) Chemical: pills, spermicide<br>(b) Mechanical: I.U.D. (intrauterine device) diaphragm, condom<br>(c) Surgical: tubal ligation vasectomy<br>(d) Ogino-Knauss<br>Basal body temperature<br>Bellings and abstention |
| 2. **To describe** how birth control methods work. | |
| 3. **To be aware** of effectiveness of birth control methods. | |
| 4. **To be aware** of the side effects of birth control methods. | |
| 5. **To discuss** the responsibility of the two partners in the choice of a method of birth control. | (a) Harmlessness<br>(b) Effectiveness<br>(c) Moral convictions<br>(d) Religious convictions |

| | |
|---|---|
| 6. **To identify** the sources of information and services for young persons under 18 years of age. | Variable according to region: inquire. |

## 5. Measurement and evaluation

### 5.1 INTRODUCTION

The essential activities of measurement and evaluation can be sketched as follows:

TO EVALUATE

is to make a judgement, leading to a decision, taking as a starting point,

SCORES OR DATA

acquired through the application of

MEASUREMENT INSTRUMENTS

oral or written examinations, objective or essay type, tests of skills, or checklists developed to measure the degree of attainment of the

OBJECTIVES

presented to the pupils during the year. "In teaching, the effectiveness of the transfer of information and the pupil's comprehension is always evaluated, consciously or unconsciously."(1)

Educational evaluation involves collecting information and analyzing it in the light of existing circumstances, in order to make as accurate an appraisal as possible.

"To evaluate, there must be something to measure and this something is generally the objectives of teaching".(2)

"Measurement and evaluation are essential instruments for the improvement of the educational activities of teachers".(3)

"In the field of education, measurement involves all activities (examinations, tests, etc.) that aim at gathering results or clues relative to various performances or operations".(4)

"The teacher who subjects his pupils to a test of educational achievement with the objective of determining the quality of their performance is measuring. The score obtained in a test has very little value in itself. For the results of a test to be significant, it must be (1) related to a framework of reference and (2) a value judgement must be made after this comparison. The measurement will have its full meaning when the teacher makes a value judgement of the significance of the score obtained."(5)

Formative evaluation is a system of evaluation that involves gathering information about a pupil's progress at several points during a learning activity. Starting with the degree of mastery (or of non-mastery) of an objective, it seeks to discover where and in what respects the pupil may be experiencing difficulties, and to assist the teacher in the choice of means most likely to ensure satisfactory progress in the learning activity.

Summative evaluation is an evaluation that occurs at the completion of an important stage of teaching/learning; for example at the end of a segment of teaching of a course or of a program. It is intended to inform the pupil, the teacher, and the parents about the mastery of a set of terminal objectives.

(1) UNESCO. L'enseignement des sciences fondamentales: Biologie, Vol. IV Tendances nouvelles de l'enseignement de la biologie "Évaluation et diffusion d'un curriculum". UNESCO, Paris, 1977 p. 62 (This citation is a free translation).

(2) UNESCO. L'enseignement des sciences fondamentales: Biologie, Vol. IV Tendances nouvelles de l'enseignement de la biologie "Évaluation et diffusion d'un curriculum". UNESCO, Paris 1977, p. 62 (This citation is a free translation.)

(3) Gouvernement du Québec, ministère de l'Éducation. Direction générale du développement pédagogique. Direction de la mesure et de l'évaluation des apprentissages. Guide docimologique, Introduction à la mesure et à l'evaluation, fas. 1, 1978. p. 2 (This citation is a free translation.)

(4) Ibid, p. 4

(5) Nadeau, Marc-André. Mesure et évaluation des objectifs pédagogiques. Les éditions St-Yves, Québec 1975, p. 66 (This citation is a free translation.)

Measurement results can be interpreted in at least two ways:

A norm-referenced interpretation compares the pupil's score in the attainment of certain objectives with those of a number of other pupils.

A criterion-referenced interpretation compares the pupil's performance with predetermined criteria, without reference to the scores of the other pupils.

A norm-referenced evaluation is generally used in a situation in which a decision about selection and/or classification has to be made. In such a situation, evaluation involves the use of measurements which compare individual performance with overall group performance.

In a situation in which a teacher is interested in knowing if the individual has attained a certain given competence, and if there are no restrictions as to the number of individuals likely to manifest this competence, criterion-referenced evaluation is the more suitable.

This type of evaluation can also be used when a teacher is interested in assessing the quality of his teaching or the value of a course.

## 5.2 A DESIRABLE SYSTEM OF EVALUATION

### 5.2.1 Measurement Based on Performance Criteria

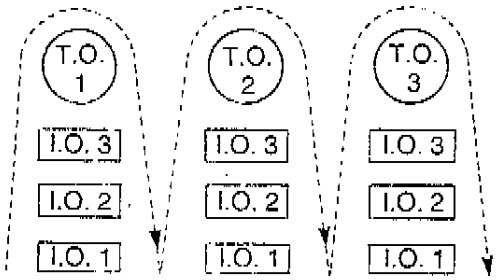
For the teacher, it is not a daily question of whether or not to evaluate or measure, but of the decisions which are to be based on the evaluation. Until now, the group has been the main point of reference for all evaluation. But with the introduction of courses whose content is defined through specific objectives, measurement during the learning process can be based on objectives for which there are definite performance criteria. Criterion-referenced measurement should be encouraged in this situation, as it involves judgements about the changes that have been effected in pupils, with the aim of improving learning rather than of certifying that it has occurred.

### 5.2.2 Course Plan

To accentuate the educational role of evaluation connected with the learning process, the course should be described and organized in a specific "course plan," with which the pupil should be familiar. This should help to orient and stimulate him to integrate the knowledge, behavior and basic skills that must be acquired to attain the proposed objectives.

A specific objective shows what the pupil should be able to do after instructional activities. The pupil should be told in advance of the anticipated changes in knowledge, skills, and attitudes.

### 5.2.3 Diagram of the System of Evaluation Suggested for the Teacher

| Instructional Decision | Measurement Criterion-referenced Type | Objective |
|---|---|---|
| |  | |
| | **Formative Evaluation**<br>Terminal Objective 1 (TO) is attained through the intermediate objectives (IO) 1, 2, and 3. The same applies to the Terminal Objectives 2 and 3. | • To collect information on the step-by-step unfolding of the learning activity.<br>• To inform the pupil of his progress. |
| | **Summative Evaluation**<br>At the end of a module, a term, or a year, a summative evaluation may be made using a criterion-referenced instrument based on the set of terminal objectives. | • To determine the extent to which a set of terminal objectives considered essential has been attained.<br>• To collate and transmit results to the parents.<br>• To decide on promotion. (administrators) |

## 5.3 SUGGESTED MEASUREMENT AND EVALUATION INSTRUMENTS

The majority of the terminal objectives of this course have been formulated so that they can be measured. The few exceptions are objectives in the affective domain.

Is the aim to have the pupil think and learn by himself? Is the objective to develop his critical faculties, to develop a vigilant attitude toward the maintenance of his health? To the extent that this is the case, it then becomes difficult, if not impossible. The teacher should recognize that, in such cases, he must search for procedures more systematic than simple intuition and approximation.

The intermediate objectives of this course lend themselves to evaluation and measurement, except for those that are introduced by expressions such as: "to determine experimentally", "to observe"; "to check the effect of", which involve methodology and are related to learning situations, or to processes, as in the case of the verb "to discover".

### 5.3.1 Congruence Between the Objectives and the Items

Validity is an important quality of a measurement instrument. It must "measure what it is supposed to measure." It is not enough that it be related to well-formulated objectives, but the questions that it contains must correspond as closely as possible to these objectives. This correspondance between an objective and a question is congruence".[1]

### 5.3.2 Table of Specifications

A summative evaluation instrument should be based on a Table of Specifications which sets out the proportion of the test that should contain questions related to knowledge, to skills, and to attitudes. This choice should take three criteria into consideration:

(a) the relative importance of the three domains of learning;
(b) the relative importance of the time allotted to the different teaching strategies;
(c) The relative importance attached to the terminal objectives of a theme.

### 5.3.3 Measurement Instruments

"A written or oral examination, a test of school achievement or of intellectual ability, the observation made by a teacher of a pupil's practical performance are all measurement instruments."[2]

A written test remains the most desirable instrument, particularly a written test that "can be scored objectively." Such a test is made up of multiple choice questions, of illustrations to recognize or to label, etc.

"If the measurement instrument is intended to improve our knowledge of the pupil, to judge his progress and to orient the teaching act, it is important for the candidate that the examination has content validity and can be scored objectively.

It should, however, be recognized that all educational measurements are imperfect and limited. It may happen that at the time the test is given, the pupil's performance may be below what he could have given had he been in a better physical or psychological condition; for this reason a set of measurements is generally more meaningful than an isolated score."[3]

The evaluation of performance skills and attitudes should concern the teacher to the same extent as the degree of mastery of cognitive objectives (knowledge). For example, the ability to summarize a text, to make a diagram, to use reference sources, to carry out composition activities, or to create audio-visual displays, may be of prime importance in the development of the pupil's autonomy.

Considering that affective objectives are occupying an increasing place in educational programs, it is pertinent to underline some of the main domains of behavior referred to in the present course.

— self-respect or self-concept (M)
— interpersonal relationships (F)
— decision-making, or solving social problems (F)

(1) Québec, ministère de l'Éducation, Direction générale du développement pédagogique. Direction de l'évaluation pédagogique. Les objectifs d'apprentissage dans l'optique de la mesure et de l'évaluation, Vol. 2, 1978, p. 14 (This citation is a free translation.)

(2) Québec, ministère de l'Éducation, Direction générale du développement pédagogique. Direction de la mesure et de l'évaluation des apprentissages. Guide docimologique: Introduction à la mesure et à l'évaluation, 1978, p. 8 (This citation is a free translation.)

(3) Québec, ministère de l'Éducation, Service général des moyens d'enseignement. Mesure et moyens d'adaptation scolaire. L'examen, instrument de mesure, série mesure et évaluation, 1975, p. 7 (This citation is a free translation.)

Legend for the available instruments of measurement:

Many (M) Few (F)

N.B. These letters (M., F.) indicate the availability of this type of measurement instrument in the lists or banks of instructional materials.

A systematic inventory of the instrumentation actually available for the evaluation of the different components of affective behavior leads to an awareness that very little valid instrumentation is available in the more complex domains of interpersonal relationships, of class atmosphere, and of decision-making. "The use of printed texts could help pupils to understand the biological literature. Questions should be short and numerous and could be constructed in an order of increasing cognitive difficulty."(1)

Oral tests (Forums, discussions) allow for the evaluation of certain of the pupil's skills, putting in evidence his knowledge and comprehension, and, at the same time, favoring the development of his critical and autonomous thought.

### 5.3.4 Observation and Evaluation Checklist

A checklist is particularly useful in the evaluation of performance and attitudes.

This approach can lead to healthy competition among the pupils.

To be effective, this checklist should be used under certain conditions:

(a) only a few predetermined points should be evaluated at a time.
(b) the criteria should be simple and few in number.

The curriculum guide that accompanies this course will show in detail an observation checklist of certain skills to be developed.

The practical work integrated into the instructional activity offers an additional source for performance assessments such as:

(1) Manual skills in the utilization of the microscope and manipulation of instruments. Observation of each pupil is required.
(2) Complete exercises involving a series of psychomotor performances such as comprehension of instructions and carrying them out, the use of the results of the exercises for lists, tables, etc.
(3) The results of practical work such as drawings, written notes, micro-preparations, deductions based on observations, which can be checked on at the completion of the practical work. These may be more easily measured by essay-type or free response examinations.(1)

Another form of evaluation is "the Pupil Self-Evaluation Form" with which the pupil can make a personal judgement of the effort and the interest he has shown in his work. This self-evaluation form should not be forced on the pupils but it should rather be presented as a means whereby they can reflect on the school work they have accomplished, in order to improve in those areas in which difficulties have been experienced(2).

(1) UNESCO. L'enseignement des sciences fondamentales: Biologie IV. Tendances nouvelles de l'enseignement de la biologie. "Evolution des moyens et des critères utilisés pour contrôler les résultats des étudiants", UNESCO, Paris, 1977. p. 108
(This citation is a free translation.)

(1) UNESCO, p. 109

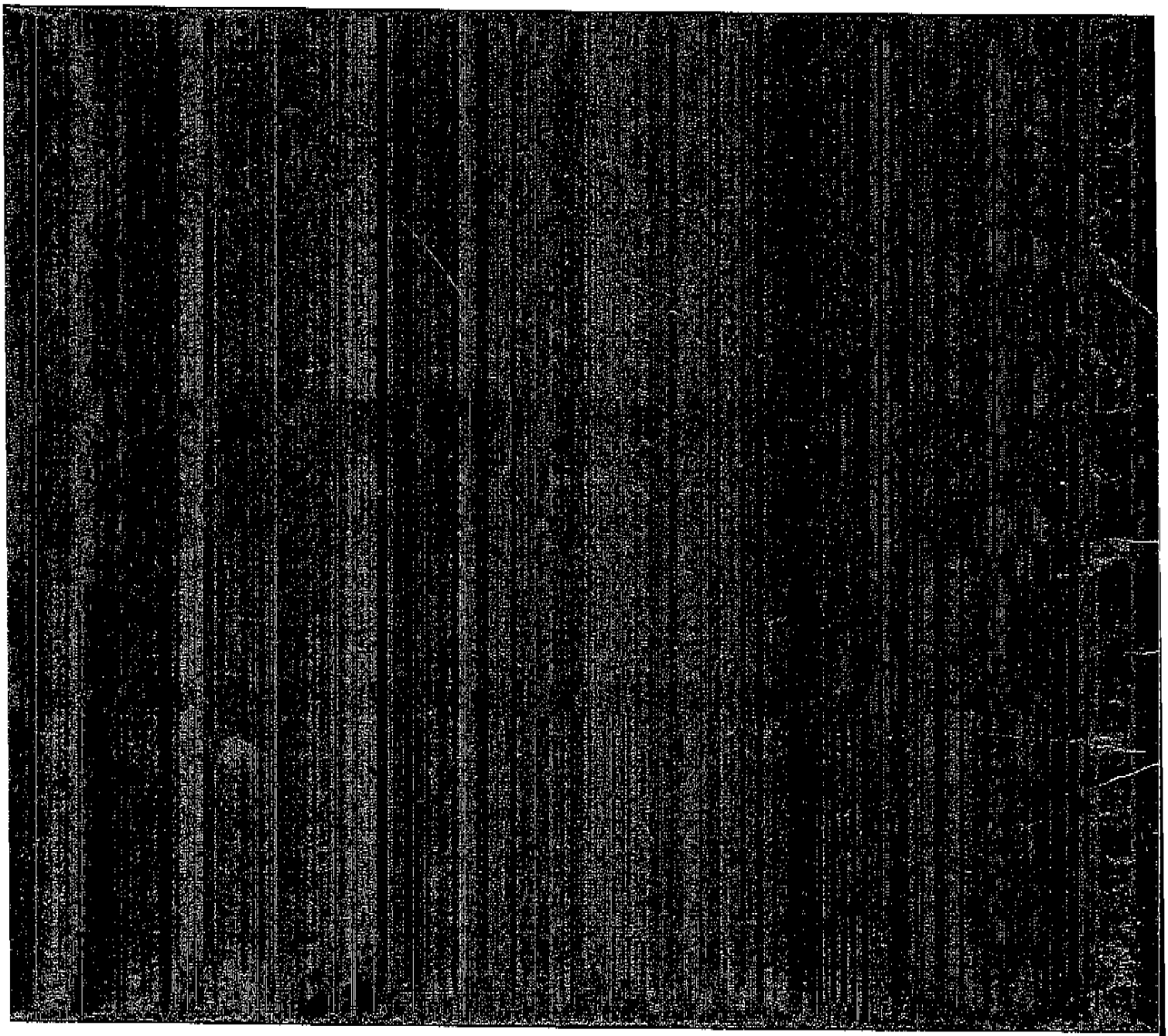
(2) Québec, ministère de l'Éducation, Service général des moyens d'enseignement. Mesure et moyens d'adaptation scolaire. Les instruments d'évaluation, série mesure et évaluation, 1975, p. 4
(This citation is a free translation.)

## 5.4 CONCLUSION

In the school, the anticipation of a passing mark in a test may be the main motivation for learning, rather than the acquisition of a skill or the advantages resulting from such an acquisition. If this attitude stimulates certain pupils, it develops in others an unjustified fear of evaluation.

The role of evaluation should be reconsidered in order to give it its proper place, that is to integrate it into daily instructional activities: to inform the pupil, to help correct deficiencies if necessary, to encourage the pupil and give him the security he needs in learning.

It is important to establish a coherent policy of measurement and evaluation in the milieu, to improve the measurement instruments and to equip the teachers so that they may carry out the important task of evaluating pupil learning.



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