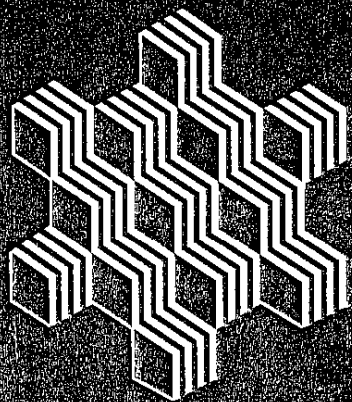


# Elementary School Curriculum



**NATURAL SCIENCE**

Québec 

# Elementary School Curriculum

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## NATURAL SCIENCE

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Approuvé par les Comités catholique et protestant  
du Conseil supérieur de l'éducation  
les 21, 22 et 29 février 1980.

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I am pleased to confirm that the program in *Natural Science* for Elementary Schools, issued in conformity with Section 18 of the Regulation Respecting the Basis of Elementary School and Preschool Organization, has received the approval of the Confessional Committees of the Conseil supérieur de l'éducation, and constitutes a program which I authorize for use in all schools beginning July 1, 1984.

A handwritten signature in cursive script, reading "Camille Laurin M.D.", written in dark ink.

Camille Laurin, M.D.  
Minister of Education

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## FOREWORD

This document is intended for all those involved in elementary school education, especially the teachers.

It presents a program that has been revised to reflect the present concerns of society in general, and of the school in particular, as identified in *The Schools of Québec*.<sup>1</sup>

This is an official program comprising a number of learning objectives to be attained by pupils during the two cycles of elementary school. The Direction des programmes of the Direction générale du développement pédagogique of the ministère de l'Éducation, with the cooperation of educators in the field — consultants, teachers, and specialists — has been responsible for its development.

A Curriculum Guide<sup>2</sup> accompanies this program and is available on request.

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1. Québec, Ministère de l'Éducation, *The Schools of Québec, Policy Statement and Plan of Action*. Québec: Éditeur officiel du Québec, 1979.

2. Québec, Ministère de l'Éducation, *Curriculum Guide — Natural Science — Cycle 1*, code 2102-01-A. *Curriculum Guide — Natural Science — Cycle 2*, code 2102-02-A. Québec, 1983.

## **TIME ALLOTMENT**

In the first cycle of elementary school, pupils need a minimum of sixty minutes of natural science a week in order to attain the objectives of the program. In the second cycle, they need at least ninety minutes of science each week. This amount of time will enable pupils to cover the minimum content of the program: to form a number of concepts as they become familiar with the experimental approach, which incorporates both attitudes and skills.

In view of the fact that science activities are of such great interest to children, teachers may wish to devote some of the free time in their teaching schedules to the subject.

# 1. INTRODUCTION

## A. Background

In the past few years there have been some significant changes in the teaching of natural science, particularly with regard to the instructional approach. It was these changes that led to the introduction of the outline-program by the ministère de l'Éducation and the school boards.

With the new developments in the field of educational theory and practice and the experience gained from implementation of the outline-program over a period of several years, it became obvious that the program needed to be revised. The primary goal in undertaking this revision was a desire to bring schools up-to-date in terms of current scientific knowledge and in relation to their environment. The revision is also a response to the requests of educators for a clearly defined program.

## B. Relationship of This Program to the Objectives of Elementary School Education

In *The Schools of Québec*, the ministère de l'Éducation has defined the aims and values on which the teaching of young people should be based. Education should "enable children... 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 roles as citizens."<sup>1</sup>

Science education fosters the development of scientific humanism and thus contributes to these aims. More specifically, natural science teaching enables children to learn about their environment, to develop the means to understand it, and to live in greater harmony with their natural surroundings.

## C. Relationship of This Program With Other Elementary School Programs

Natural science is closely related to other subjects and shares some common areas of concern, in particular:

- the subject of study: the environment;
- the way it is approached: the scientific method.

Directly or indirectly, the focus of learning in all elementary school subjects is the environment. In mathematics, arts, language, and moral and religious education, the environment is studied from different perspectives. In broad terms, social studies is primarily the study of social man and his environment, whereas natural science is the study of the biological, physical, and technological dimensions of the environment.

In this program, pupils learn to use the scientific method from the beginning of elementary school, and it is by this means that they begin to interact with their environment and gradually come to know and understand it. There are a

number of subjects in which the scientific method can be used: mathematics, English, social studies, and natural science among others.

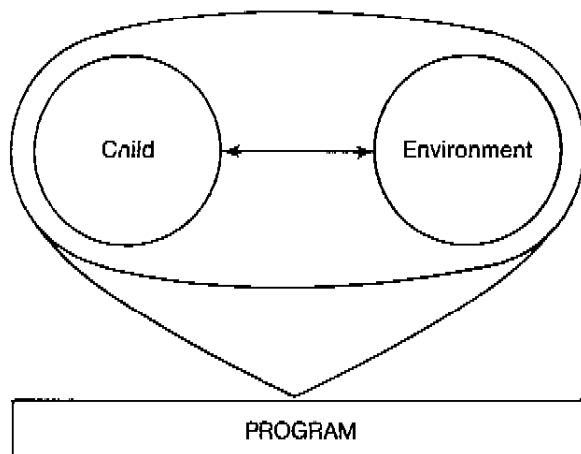
In natural science, learning is based on systematic observation, manipulation, and experimentation, and consequently more emphasis has been placed on these skills in this program than in other science programs. Natural Science, therefore, is particularly well-suited to helping children become familiar with the experimental approach; a technique which enables them, with their natural bent for experimenting, to increase their knowledge and understanding of the environment.

1. Ministère de l'Éducation, op. cit. p. 29.

## II. GENERAL ORIENTATIONS

Every learning situation involves a learner and a subject to be learned. This program is designed to take into consideration the pupil, the environment, and their interrelationship. The learning activities have been adapted to the pupils' needs and capacities, without detracting from the main focus of the program, which is the conservation of environmental resources.

DIAGRAM 1



### A. Understanding the Child

The following brief description of the elementary school child focuses mainly on his needs and characteristics, and his way of understanding the world. It should give teachers a clearer understanding of the psychological principles on which the program is based.

#### 1. Needs and Characteristics

The way in which a child behaves is determined by a variety of needs: these may be innate, or acquired as the child grows and develops, or they may be ones that crop up in everyday life:

- **Physical Needs:**  
Water and a healthy diet, fresh air, space, exercise, relaxation. . . These kinds of needs must be met if pupils are to be active and to fulfill their potential.
- **Psychological Needs:**  
*Need to love and to be loved:* need for security, stability, appreciation, self-esteem. . . These are needs that pupils fulfill mainly through their relationships with their families, friends, teachers, and their broader environment.

*Need to Express Himself and To Understand:* these are needs of a cognitive nature linked to the satisfaction of physical and emotional needs. The daily reality of the

physical and technological world presents the pupil with situations that lead him to ask questions and to try to find answers to them.

#### 2. Learning and The Child

Learning takes place when the individual is faced with a situation which constitutes a problem for him. When the child encounters a physical, affective, social, or intellectual problem, the challenge prompts him to direct his energy to finding a satisfactory solution.

Each child has his own innate capacities and talents which enable him to learn about the world around him in his own way. Natural science should help elementary school pupils to become aware of their environment, to learn about it, and gradually, as the need or motivation inspires them along the way, to discover it for themselves.

### B. Natural Science and the Environment

The previous section covered some of the important characteristics of the elementary school child. This section describes the environment with which he interrelates.

#### 1. Environment

Man's environment is everything that makes up the framework of his life: all the areas that influence and affect him and which he, in turn, influences and affects. Biological and physical features constitute the natural basis of the environment, but there are also cultural, technological, political, and economic dimensions to this environment. Environment, in the broadest sense, encompasses far more than the natural environment, which comprises only the physical, biological, and technological dimensions of the whole. The urban child's environment is the street, the park, and the factory, whereas the rural child's environment is the field, the forest, the village, and the road leading to the next village. For both of them, their environment includes family, friends, the classroom, the schoolyard, the butterfly they find, in short, all those things which arouse their interest and curiosity, and constantly fuel their desire to know and their need to communicate.

#### 2. Natural Science

The environment, in terms of a whole set of systems, may be divided into two broad categories: "the natural environment and the man-made environment, each composed of elements which interact constantly."<sup>1</sup> It is the natural environment category which is the subject of study in natural science.

As previously mentioned, the environment is the subject of study in several disciplines. In natural science, this study covers the physical, biological, and technological dimensions of the environment and their interrelationships.

In the study of natural science, the child constructs his knowledge of the environment, with special emphasis on the natural environment. He learns about living things, nonliving things, energy, and the many ways in which all of these

1. Québec, Ministère de l'Environnement, *Du concept d'environnement à celui de l'éducation à l'environnement*, 1979. (This citation is a free translation.)

interact. Natural science also encourages the child to develop responsible attitudes and conduct towards environmental resources.

### 3. Environmental Education

From the birth of civilization, and particularly from the beginning of the industrial era, man has made remarkable progress and increasingly complex discoveries in science and technology. This evolution is presently escalating at such a rate and has caused such rapid and profound changes in man's thinking and his way of life that it would be more accurate to call it a revolution.

While the revolutions of the twentieth century have had many positive aspects, they have also had many adverse effects in terms of abuse of the natural environment, which sustains life and is the reservoir of natural resources and energy sources. Pressure on the natural environment caused by our life has become so great that the present situation can truly be described as an "environmental crisis."

A number of proposals have been put forward as to how to reverse this trend and re-establish the balance between man and the environment: efforts should be made to bring about a change in people's attitudes, to put an end to the wastage caused by overconsumption of resources, to ensure more rational management of resources, and so on.

It is, however, generally recognized that priority should be given to environmental education as the first step in redressing this situation because the solution will only come from a significant change in attitudes and behaviour. Natural science is an ideal vehicle for helping children to become aware of their responsibility to the environment. This awareness should lead to positive patterns of conduct towards the the environment that are compatible with "a new environmental ethic based on respect for nature, and for man and his dignity, on concern for the needs of future generations, and on the importance of a better quality of life available to all, an ethic supported by the active and cooperative participation of everyone."<sup>1</sup>

### C. The Goals of the Program

The following goals were determined on the basis of the general orientations outlined in this section and are designed to take into consideration the child, the environment, and their relationship.

The aim of the Natural Science program is to enable the pupil:

- to satisfy both his physical and psychological needs;
- to come into contact with his environment;
- to become aware of the elements of the natural environment;
- to build and structure his knowledge as he becomes familiar with the experimental approach;

- to develop a sense of responsibility towards environmental resources.

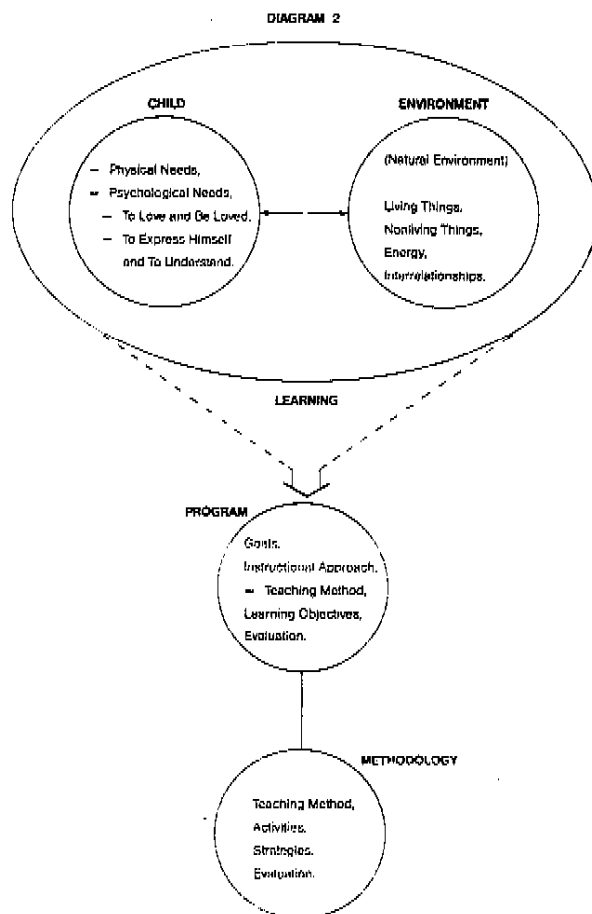
It is hoped that this program will not only contribute to the child's overall development *through* the study of the environment, but will also ensure, *for* the environment itself, rational utilization of its resources.

### D. Instructional Approach

The teacher has a very important role to play in providing children with meaningful learning experiences that will achieve the goals of the program.

#### 1. The Role of the Teacher

It is the teacher's responsibility to facilitate the development of the child-environment relationship and to allow children to express their needs. The teacher should set up a variety of concrete situations for the children that will give them different types of learning experiences and allow them to make their own choices.



1. The Intergovernmental Conference on Environmental Education, organized by Unesco in cooperation with UNEP in Tbilisi, Georgia, U.S.S.R., October 14<sup>th</sup>-26<sup>th</sup>, 1977. (This citation is a free translation.)

The teacher should be a guide and resource person for pupils as they begin to ask questions and try to find the answers to them. He should encourage children to form concepts gradually as he helps them to develop competence in using the experimental approach. The teacher should make sure that his teaching strategies are adapted to the capabilities and needs of his pupils.

## **2. Overall Approach**

Teachers in elementary school should make sure that their pupils become aware of the many interactions within the environment that maintain the increasingly precarious balance of nature. Experience has shown that if teachers do not make sure that children develop this awareness in elementary school, it is much more difficult later on to develop the level of knowledge and understanding they need to become responsible citizens. The ultimate goal of the Natural Science program is to enable pupils to develop responsible attitudes and conduct toward the environment. A knowledge of the interrelationships in the environment is fundamental to an understanding of natural phenomena.

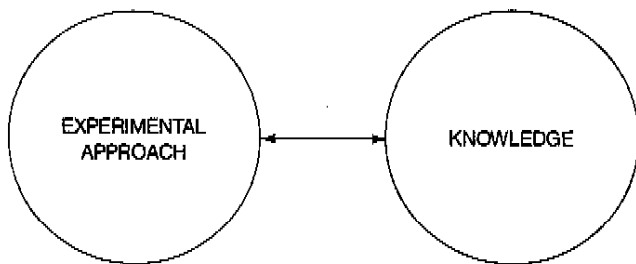
Pupils will be far more likely to develop a sound knowledge and understanding of the environment if the teacher adopts a broad approach which allows him to interrelate all the different elements of the environment studied in the program.

A global or holistic view of the environment is necessary if pupils are to understand natural phenomena. If teachers use a systemic, open approach they can group specific topics together into a coherent whole. This type of approach will help pupils learn the fundamental concepts. Teachers should organize the learning objectives and the accompanying activities suggested in the curriculum guide to enable them to follow this approach.

### III. DESCRIPTION OF THE PROGRAM CONTENT

The aim of the Natural Science program is to help the child build and structure his knowledge and become familiar with the experimental approach. It is not simply a question of acquiring knowledge in a vacuum, nor of learning to use the experimental approach for its own sake. These two factors are interdependent: each serves to complement the other.

DIAGRAM 3



#### A. Experimental Approach

The subject of natural science comprises a group of specific learning experiences and is therefore particularly well-suited to the learning method called the experimental approach. This approach is a technique which scientists use to increase their body of knowledge about the environment. The main steps in this approach are outlined here and some important points are discussed. In essence, it is a problem-solving technique.

It is through their initial exploratory activities that children first come to know their environment, to appreciate it, and to develop attitudes, skills, and techniques which will help them become proficient at using the experimental approach. Children build their fund of knowledge through observing, conducting small experiments, asking questions, reading, watching films, and so on. As they progress, pupils will want to know more about living things, nonliving things, and natural phenomena. This curiosity often leads them to ask themselves questions and to identify problems. If a problem corresponds to a need, children will initiate procedures to find an answer or solution to the problem. This procedure usually comprises the following steps:

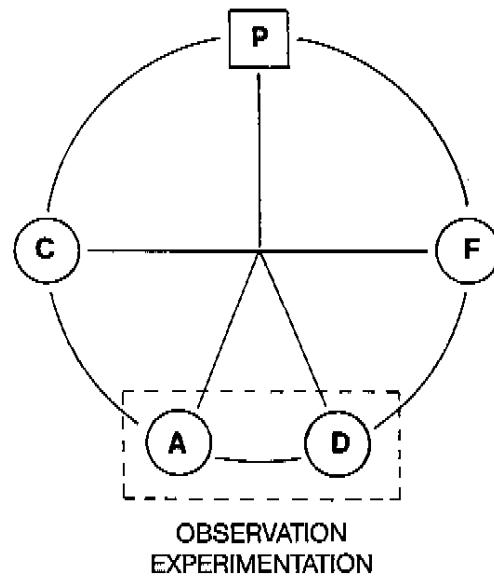
1. Pupils ask themselves a question and define the *Problem*. (P)
2. They *Formulate* one or more working hypotheses for the problem. (F)
3. In order to verify the validity of their working hypotheses, they analyze the elements of data by

making observations, carrying out an investigation, or performing an experiment. This phase comprises two steps:

- a. *Gathering Data*; (D)
- b. *Analyzing Data*. This involves comparing, classifying, and interpreting the data selected on the basis of the hypotheses formulated: (A)  
measuring the data against the hypotheses.

4. They draw one or more *Conclusions* and present the (C) results, if required.

DIAGRAM 4



It would be a mammoth task to try to describe the thinking process which the human mind goes through in particular situations; such a task is complicated by the fact that this complex, flexible, and circuitous process is not always consistent and varies according to the type of problem involved. Any attempt to describe it tends to produce a breakdown of somewhat artificial components. Consequently, only the salient steps in the process are outlined here.

The main aim of natural science teaching is to help pupils develop and use all the means of acquiring knowledge, and to learn to use a problem-solving technique, based on logical reasoning. This technique encompasses both skills and attitudes.

#### 1. Skills

Teachers who have taught the former program know that it focused primarily on skill development. Pupils were encouraged to develop basic skills such as observing, classifying, measuring, inferring, predicting, and communicating. Other more complex skills such as making operational definitions, controlling variables, formulating hypotheses, interpreting data, and formulating models, were also taught. In the new program these skills continue to be an important concern, but they are incorporated within the context of a broader approach.

As an example, pupils analyze the data they have gathered on the basis of the working hypothesis they have formulated. The fact that they are able to classify, to infer, and to predict, among other skills, will help them to carry out this step. This activity provides pupils with an opportunity, once they have some grasp of these skills, to reinforce them.

It is, then through the process of using the experimental approach that pupils are able to improve their skills. These skills, in turn, help them to build up their knowledge and to develop competence in using this approach.

## 2. Attitudes

As pupils become familiar with the experimental approach, they will develop a number of attitudes that are integral to it.

- curiosity,
- objectivity,
- critical thinking,
- creativity,
- self-confidence,
- openness toward others,
- prudence,
- perseverance.

The relationship between these attitudes and the experimental approach is the same as that described earlier for skills. The attitudes are helpful during each step of the procedure and they enable children to develop a number of skills and to learn more about the environment. As they are practised, these attitudes will be reinforced.

Curious by nature, children use all their senses in exploring the world around them and in seeking to know and understand it. They begin to experience a sense of wonder as they perceive the beauty and grandeur of nature in all its complexity and fragility. The more they learn about the natural world, the more they come to understand and enjoy it.

Pupils gradually develop a greater awareness of existing problems such as pollution, the energy crisis, the shortage of drinking water, endangered species of animals and plants, and at the same time, they become cognizant of the consequences of these problems on their own lives. As they become aware of the problems that surround them and of their consequences, pupils normally develop positive attitudes that will lead them to become individuals and citizens who will work to improve the quality of the environment and the quality of life in this environment.

## B. Building and Structuring Knowledge

In the Natural Science program pupils become increasingly adept in the use of the experimental approach, which comprises attitudes and skills. The program is also an ideal vehicle for fostering the acquisition of knowledge and the formation of concepts.

The process of forming a concept may take a long but variable amount of time. It is closely related to the intellectual development of the child. Some people feel that it is a process which continues throughout an individual's lifetime. The individual continues to develop and modify his understanding of concepts through his many experiences.

It is by participating in a variety of concrete activities that pupils form concepts of increasing scope and depth. They build and structure their knowledge through observations, experiments, and investigations, and they integrate this knowledge in order to increase their understanding of the concept they are constructing. This process is repeated over and over again as the pupil's knowledge expands. Pupils form concepts that range from simple to complex, and from concrete to abstract.

Key concepts like "cycle" and "life" are unifying or organizing concepts which are extremely complex. These are formed step-by-step throughout the learning process.

## Subjects for Exploration

The program covers two broad subjects, matter and energy, which are integral to the *principal unifying concept of the program: the environment*.

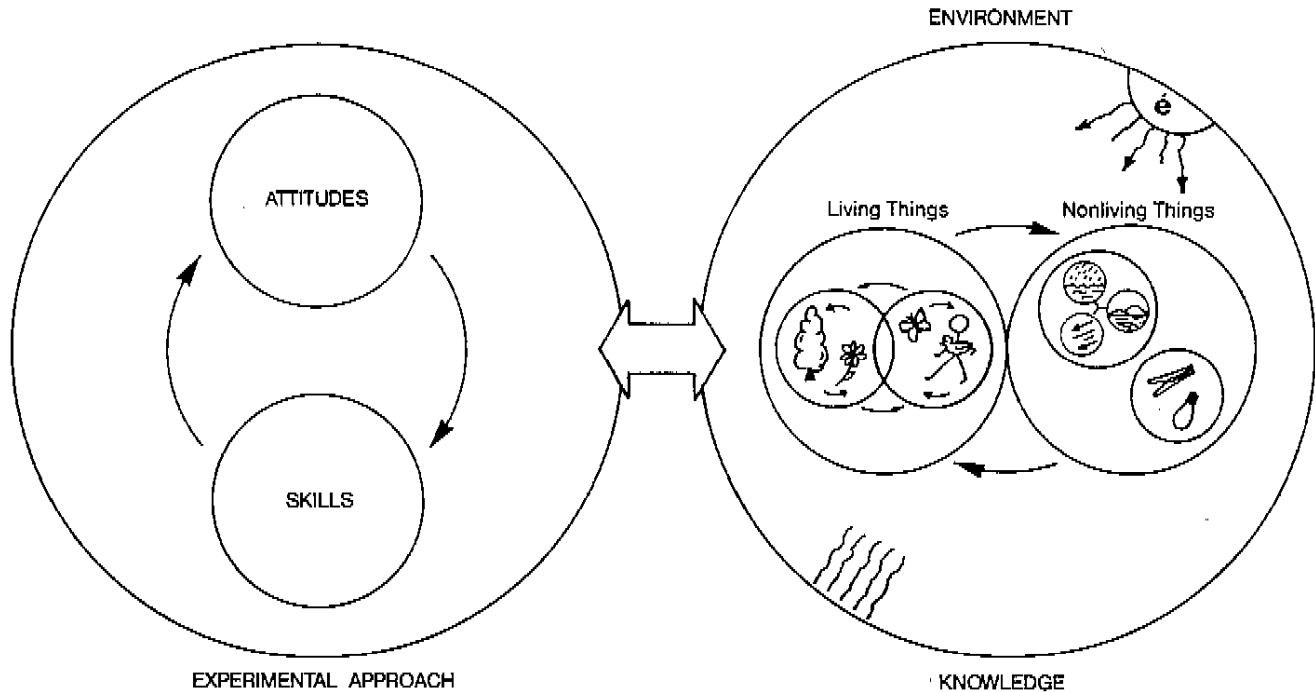
The first subject deals with living and nonliving things. Pupils learn about plants, animals, water, air, soil, and manufactured goods that are found in their environment. The activities that pupils pursue will also help them to become familiar with the many ways these elements interrelate. They will learn about the major problems of today, such as conservation\* of resources, air and water pollution, and imbalances in the ecosystems.

The second subject, energy, is not covered in one specific section. In order to present a realistic view of the environment, the study of energy has been integrated into every section of the program.

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\* Conservation means rational use of resources: it involves protection, planning, and rational management. It does not mean non-use.

DIAGRAM 5



## C. Learning Objectives

### 1. Overall Objectives of the Program

The aim of natural science teaching in elementary school is to achieve, in whole or in part, some of the aims stated in the *Schools of Québec*.<sup>1</sup>

To enable pupils:

- I. To develop as autonomous and creative individuals in a scientific and technological society.
- II. To develop a spirit of scientific inquiry.
- III. To gradually develop an understanding of the realities of their natural and technological environment.
- IV. To become familiar with existing environmental problems.
- V. To develop responsible attitudes and behaviour conducive to conservation of environmental resources.

### 2. General Objectives

The general objectives delineate the specific areas of study which lead to the attainment of the overall objectives.

### 3. Terminal Objectives

Each general objective is followed by a number of terminal objectives designed to lead to its attainment. The terminal objectives are *compulsory*.

### 4. Intermediate Objectives

Each terminal objective is accompanied by one or more intermediate objectives. These are offered as suggestions only, to allow for individual initiative and regional differences. They should be viewed as worthwhile avenues to explore for the purpose of achieving the terminal objectives.

### 5. Related Content

Some of the intermediate objectives have corresponding related content which gives detailed information designed to help teachers plan their strategies. The related content is optional.

<sup>1</sup> Ministère de l'Éducation, op. cit., p. 30-31.

## SUMMARY CHART

### Overall Objectives of the Natural Science Program

TO ENABLE PUPILS:

- I. TO DEVELOP AS AUTONOMOUS AND CREATIVE INDIVIDUALS IN A SCIENTIFIC AND TECHNOLOGICAL SOCIETY.
- II. TO DEVELOP A SPIRIT OF SCIENTIFIC INQUIRY.
- III. TO GRADUALLY DEVELOP AN UNDERSTANDING OF THE REALITIES OF THEIR NATURAL AND TECHNOLOGICAL ENVIRONMENT.
- IV. TO BECOME FAMILIAR WITH EXISTING ENVIRONMENTAL PROBLEMS.
- V. TO DEVELOP RESPONSIBLE ATTITUDES AND BEHAVIOUR CONDUCIVE TO CONSERVATION OF ENVIRONMENTAL RESOURCES.

GENERAL OBJECTIVES

#### EXPERIMENTAL APPROACH (PROCEDURE, SKILLS, AND ATTITUDES)

1. TO DEVELOP HIS PERSONAL POTENTIAL IN A HARMONIOUS MANNER.
2. TO LEARN ABOUT GROUP LIFE AND TEAM WORK WITHIN A DEMOCRATIC SETTING.
3. TO APPRECIATE THE RICHNESS AND THE BEAUTY OF NATURE.
4. TO DEVELOP ATTITUDES WHICH WILL AID HIM IN BECOMING FAMILIAR WITH THE EXPERIMENTAL APPROACH AND IN BUILDING AND STRUCTURING HIS KNOWLEDGE.
5. TO DEVELOP SKILLS AND COMPETENCE IN THE USE OF THE EXPERIMENTAL APPROACH.
6. TO BECOME FAMILIAR WITH THE USE OF CERTAIN TOOLS WHICH WILL HELP HIM TO EXPLORE THE ENVIRONMENT.

#### (KNOWLEDGE)

7. TO BECOME FAMILIAR WITH THE *PLANT WORLD* AND ITS INTERRELATIONSHIPS WITH OTHER LIVING THINGS AND THE PHYSICAL ENVIRONMENT; TO DEVELOP RESPONSIBLE ATTITUDES AND BEHAVIOUR TOWARD THIS RESOURCE.
8. TO BECOME FAMILIAR WITH THE *ANIMAL WORLD* AND ITS INTERRELATIONSHIPS WITH OTHER LIVING THINGS AND THE PHYSICAL ENVIRONMENT; TO DEVELOP RESPONSIBLE ATTITUDES AND BEHAVIOUR TOWARD THIS RESOURCE.
9. TO BECOME FAMILIAR WITH *WATER* AND ITS INTERRELATIONSHIPS WITH THE OTHER ELEMENTS OF THE ENVIRONMENT; TO DEVELOP RESPONSIBLE ATTITUDES AND BEHAVIOUR CONDUCIVE TO RATIONAL USE OF THIS RESOURCE AND THE BENEFITS MAN GAINS FROM IT.
10. TO BECOME FAMILIAR WITH *AIR* AND ITS INTERRELATIONSHIPS WITH OTHER ELEMENTS OF THE ENVIRONMENT; TO DEVELOP RESPONSIBLE ATTITUDES AND BEHAVIOUR CONDUCIVE TO RATIONAL USE OF THIS RESOURCE.
11. TO BECOME FAMILIAR WITH *SOIL* AND ITS INTERRELATIONSHIPS WITH THE OTHER ELEMENTS OF THE ENVIRONMENT; TO DEVELOP RESPONSIBLE ATTITUDES AND BEHAVIOUR CONDUCIVE TO RATIONAL USE OF THIS RESOURCE AND THE BENEFITS MAN GAINS FROM IT.
12. TO BECOME FAMILIAR WITH *MANUFACTURED GOODS*; TO DEVELOP RESPONSIBLE ATTITUDES AND BEHAVIOUR CONDUCIVE TO RATIONAL USE OF MANUFACTURED GOODS.

## D. CONTENT

This program comprises a set of learning objectives which pupils should achieve by the end of either the first or the second cycle of elementary school. These objectives are designed to foster the development of the skills of scientific inquiry, by providing opportunities for pupils to become familiar with the experimental approach and the attitudes and skills which it encompasses, and to acquire the knowledge that will enable them to gradually form concepts.

For clarity, the content has been divided into a number of separate objectives. In practice, however, teachers may have their pupils work towards several objectives concurrently during the learning activities.

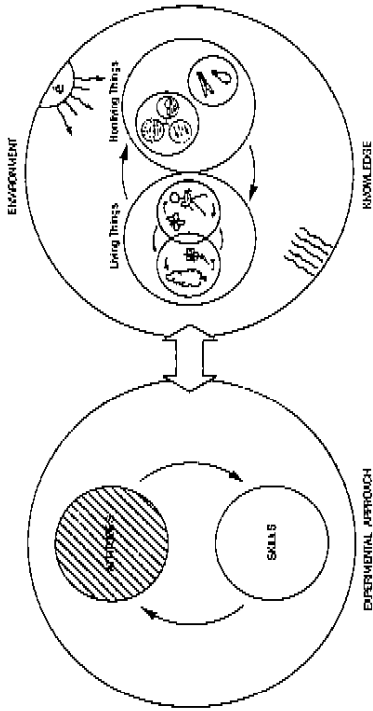
A small version of Diagram 5 is placed beside each general objective. The hatched area indicates the dimension which should be emphasized in pursuing the terminal and intermediate objectives which accompany the general objective.

### KEY

- \* : An asterisk in front of a terminal objective means that this objective should be achieved by the end of the cycle indicated. An asterisk in front of an intermediate objective indicates the cycle in which it would be best to pursue this objective.
- : A dash in front of a terminal objective means that this objective should be pursued throughout the cycle indicated, but it does not necessarily have to be achieved by the end of the cycle. A dash in front of an intermediate objective means the same thing, but the suggestion is optional.
- - : Dashes in both columns in front of a terminal or an intermediate objective mean that this objective should be pursued throughout both cycles, but does not necessarily have to be achieved by the end of elementary school.

### 1.0 General Objective

To develop his personal potential in a harmonious manner.

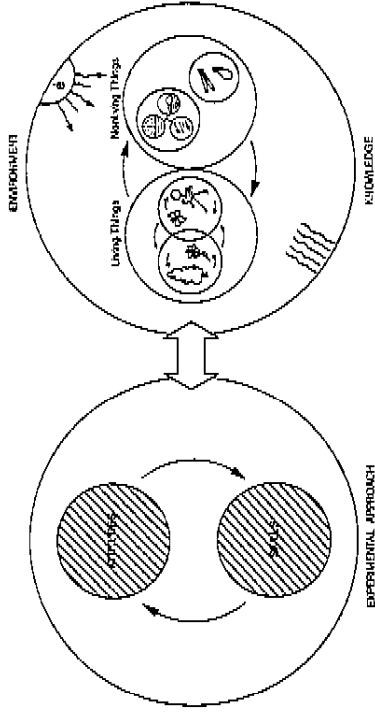


	Terminal Objectives				Intermediate Objectives	Related Content
	2nd cycle	1st cycle	2nd cycle	1st cycle		
1.1	-	-	-	-	1.1.1 To contribute to the creation of a relaxed atmosphere favourable to the exchange of ideas during science activities.	
	-	-	-	-	1.1.2 To express his preferences and interests in order to assist the teacher in planning activities.	
	-	-	-	-	1.1.3 To be himself, to be spontaneous in his observations during science activities.	
	-	-	-	-	1.1.4 To take the initiative during science activities.	
	-	-	-	-	1.1.5 To become aware of the consequences of his acts and movements as he explores his environment.	

1st cycle	2nd cycle	Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
-	-	<p>1.2 To develop his creative imagination in order to stimulate his consciousness of his natural surroundings and the solving of problems which interest him.</p>	-	-	<p>1.2.1 To develop his curiosity about and attention for everyday phenomena.</p> <p>1.2.2 To experience a sense of wonder in dealing with living things, nonliving things, and natural phenomena.</p> <p>1.2.3 To develop a questioning attitude towards the things he perceives in his environment.</p>	

## 2.0 General Objective

To learn about group life and team work within a democratic setting.

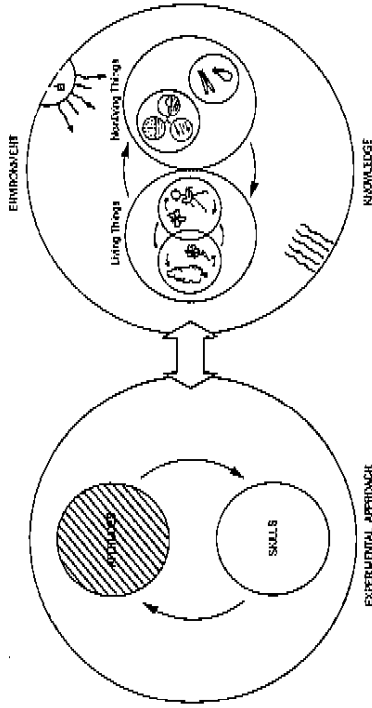


Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
2.1 To develop a gradual awareness of the requirements of working as a member of a group.	-	-	<p><b>To develop:</b></p> <p>2.1.1 respect and tolerance for others;</p> <p>2.1.2 co-operation and willingness to assist others;</p> <p>2.1.3 honesty in word and deed.</p> <p><b>To acquire the habits of:</b></p> <p>2.1.4 orderliness, neatness;</p> <p>2.1.5 punctuality.</p> <p><b>To learn:</b></p> <p>2.2.1 To plan the organization of an activity.</p> <p>2.2.2 To evaluate the work of a team and the contributions of its members.</p> <p>2.2.3 To take the role of group leader.</p>	
2.2 To learn teamwork.	-	-		

Terminal Objectives		1st cycle	2nd cycle	Intermediate Objectives	Related Content
1st cycle	-	-	-	2.2.4 To report ideas, results, and conclusions.	
2nd cycle	-	-	-	2.2.5 To fulfill his responsibilities as a team member in carrying out a group project.	
1st cycle	-	-	-	2.3.1 To acquire a concern for accuracy in oral and written communications.	
2nd cycle	-	-	-	To learn the use of various means of communication such as:	
1st cycle	-	-	-	2.3.2 histograms and graphs;	
2nd cycle	-	-	-	2.3.3 models;	
1st cycle	-	-	-	2.3.4 drawings, diagrams, tables;	
2nd cycle	-	-	-	2.3.5 audio-visual equipment.	

### 3.0 General Objective

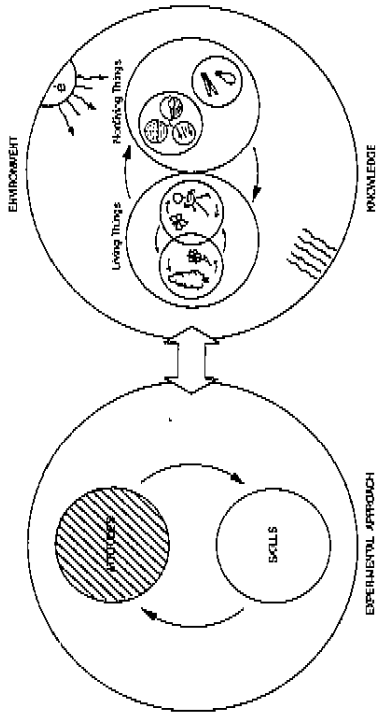
To appreciate the richness and the beauty of nature.



Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
3.1 To satisfy his curiosity about nature.	-	-	<p>3.1.1 To acquire the habit of carrying out personal research using library resources.</p> <p>3.1.2 To engage in hobbies or recreational activities of a scientific nature.</p> <p>3.1.3 To examine living things and nonliving things to develop an appreciation of them.</p> <p>3.1.4 To accord proper care to living things in the environment.</p> <p>3.1.5 To take notes and make sketches of plants and animals so as to develop a better understanding of them.</p>	
3.2 To appreciate the ways in which living things and nonliving things contribute to his physical and psychological well-being	-	-	<p>3.2.1 To appreciate the beauty of nature, and to express this.</p> <p>3.2.2 To feel comfortable in a variety of natural settings.</p> <p>3.2.3 To allay any unfounded fears he may have about plants and animals.</p>	

#### 4.0 General Objective

To develop attitudes which will aid him in becoming familiar with the experimental approach and in building and structuring his knowledge.

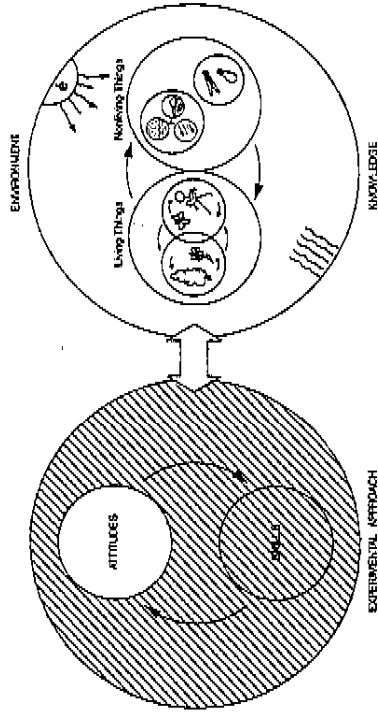


Terminat Objectives				Intermediate Objectives	Related Content
2nd cycle	1st cycle	2nd cycle	1st cycle		
-	-	-	-	4.1.1 To be receptive to the ideas of others.	
-	-	-	-	4.1.2 To ask questions to make sure that he has correctly understood the statements of others.	
-	-	-	-	4.1.3 To discuss quietly.	
-	-	-	-	4.1.4 To use various means of communication.	
-	-	-	-	4.1.5 To develop the habit of gathering information and writing on science topics.	
-	-	-	-	4.1.6 To demonstrate prudence in making statements.	
-	-	-	-	4.2.1 To listen to, and evaluate objectively, the positions, comments, arguments, and ideas presented by others.	
-	-	-	-	4.2.2 To accept points of view contradictory to his own and to change his opinion, if the evidence warrants it.	

	1st cycle	2nd cycle	Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
	-	-	4.3 To reinforce attitudes and interests which might develop during science activities.	-	-	<p>4.3.1 To accept the challenge presented by problem-solving situations.</p> <p>4.3.2 To develop a creative approach to problem solving.</p> <p>4.3.3 To persevere when faced with a difficult problem.</p> <p>4.3.4 To use originality in solving problems.</p> <p>4.3.5 To use care in handling living things, nonliving things, and unknown products.</p> <p>4.3.6 To display a willingness to improve work habits.</p>	
	-	-	4.4 To develop the desire to evaluate findings so as to improve accuracy through more methodical work.	-	-	<p>4.4.1 To develop his own criteria for evaluating his work.</p> <p>4.4.2 To evaluate his own work.</p> <p>4.4.3 To ask other pupils and the teacher to evaluate his work.</p>	

### 5.0 General Objective

To develop skills and competence in the use of the experimental approach.

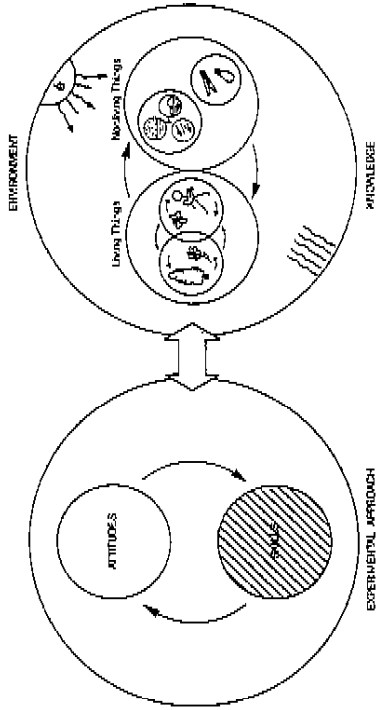


Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
5.1 To perfect various simple skills.	-	*	<p>5.1.1 To use his senses to obtain the greatest amount of data possible on living things.</p> <p>5.1.2 To classify, order, and compare living things, nonliving things, or phenomena in accordance with one or more common properties.</p> <p>5.1.3 To use non-standard units for measurement.</p> <p>5.1.4 To use standard units of measure.</p> <p>5.1.5 Based on observation, to formulate reasonable explanations (make inferences).</p> <p>5.1.6 On the basis of given data, to make one or more predictions.</p> <p>5.1.7 To communicate his observations, the results of experimentation or investigation, in a manner which is precise, concise, and effective.</p> <p>5.1.8 To situate a living thing or a nonliving thing in his environment in time and space.</p>	

1st cycle	2nd cycle	Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
	<ul style="list-style-type: none"> <li>• 5.2 To identify the principal steps of the experimental method used to solve a simple problem.</li> </ul>			<ul style="list-style-type: none"> <li>• 5.2.1 To state a problem in a clear, precise, and concise manner.</li> <li>• 5.2.2 To propose a possible explanation or solution for a given problem (hypothesize).</li> <li>• 5.2.3 To make use of pertinent reference sources.</li> <li>• 5.2.4 To take into consideration the greatest possible amount of relevant data.</li> <li>• 5.2.5 To record data.</li> <li>• 5.2.6 To plan experiments carefully.</li> <li>• 5.2.7 To relate the results of his experiments and observations to a possible explanation so as to confirm or reject it.</li> <li>• 5.2.8 When an explanation (hypothesis) is demonstrated to be untrue, to formulate a new one.</li> <li>• 5.2.9 When an explanation (hypothesis) is confirmed, to draw appropriate conclusions from it.</li> <li>• 5.2.10 To know how to communicate his results.</li> </ul>		

## 6.0 General Objective

To become familiar with the use of certain tools which will help him to learn about his environment.

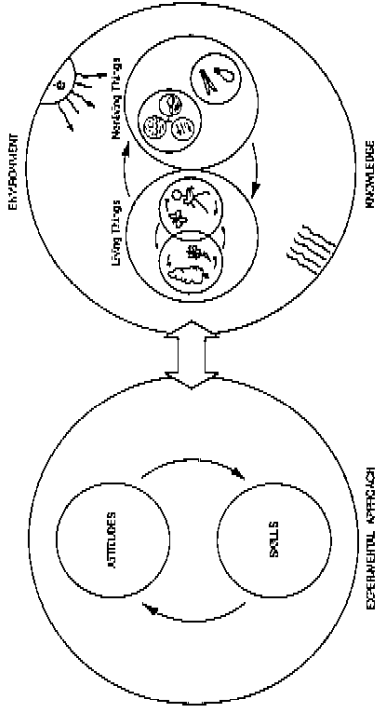


Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
6.1 To develop skills which will be useful in the study of science.	-	-	6.1.1 To develop manual dexterity. 6.1.2 To develop the ability to work systematically.	
6.2 To use simple measurement and observation instruments to obtain information about the environment which could not be obtained by the unaided senses.	-	*	6.2.1 To use simple measurement instruments. 6.2.2 To use simple meteorological instruments.	Meter stick, balance (simple, beam, dynamometer), clock, stop watch, graduated cylinder, eye dropper beaker. Thermometer, barometer, anemometer, weather vane, rain gauge, hydrometer, psychrometer, evaporimeter.
	-	*	6.2.3 To use simple instruments to make observations.	Loupe or magnifying glass, binocular loupe, binoculars, microscope, camera, tape recorder.

	1st cycle	2nd cycle	Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
	1st cycle	2nd cycle	6.3 To use a variety of methods to record and interpret data.	*		6.3.1 To construct and interpret: — a histogram — a graph	
			6.4 To learn techniques which will enable him to investigate living and nonliving things in his environment.	*		6.3.2 To construct and interpret a variety of diagrams and models. 6.3.3 To use analogies to explain ideas or concepts. 6.4.1 To set up an aquarium which reflects, as closely as possible, the natural habitat of living things in it. 6.4.2 To set up a terrarium which reflects, as closely as possible, the natural habitat of the living things in it. 6.4.3 To set up an incubator and hatch some eggs. 6.4.4 To learn to use symbols for the identification of plants, animals, and minerals. 6.4.5 To learn to observe, identify and make casts of animal tracks. 6.4.6 To learn to observe signs of plant and animal life. 6.4.7 To use a microscope to observe plant and animal cells which he has prepared.	

## 7.0 General Objective

To become familiar with the plant world and its interrelationships with other living things and the physical environment; to develop responsible attitudes and behaviours toward this resource.



2nd cycle	1st cycle	1st cycle	2nd cycle	Intermediate Objectives	Related Content
*	*	7.1 To recognize similarities and differences between plants, animals, and human beings.	*	7.1.1 To discover similarities and differences between himself and a plant. 7.1.2 To discover similarities and differences between himself and an animal. 7.1.3 To discover similarities and differences between a plant and an animal.	Reproduction, nutrition, and movement. Gait, prehension (grip), types of food. Food chain, modes of reproduction, nutrition, movement, gait, prehension.
*	*	7.2 To identify some of the characteristics of plants and links which exist between himself and plant life.	*	7.2.1 To express some of the feelings and impressions experienced when exposed to the diversity of plant life which he observes by means of his senses. 7.2.2 To compare his own growth pattern with that of a plant. 7.2.3 To express what he experiences during identification activities for various forms of plant life. 7.2.4 To appreciate the fragility of plant life. 7.2.5 To appreciate the nutritive and medicinal value of certain plants.	

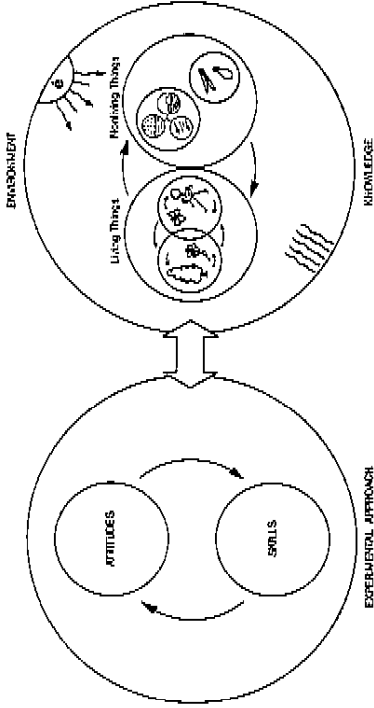
1 <sup>st</sup> cycle	2 <sup>nd</sup> cycle	Terminal Objectives	1 <sup>st</sup> cycle	2 <sup>nd</sup> cycle	Intermediate Objectives	Related Content
•	•	7.3 To represent the life cycle of a flowering plant.	•	•	7.3.1 To describe the stages of growth of an easily grown flowering plant from seed to maturity. 7.3.2 To describe the development of a deciduous tree over a period of a year. 7.3.3 To use a histogram to illustrate the growth of a plant which he has raised. 7.3.4 To describe the process of reproduction in a flowering plant.	Seed, germination, development, flowering, formation of fruit. Times of development, loss of leaves, growth, hard and soft tissues.
•	•	7.4 To illustrate the structures of a flowering plant.	•	•	7.4.1 To identify the principal parts of a flowering plant that he has grown from seed to the bearing of fruit. 7.4.2 To recognize the reproductive organs of a flowering plant. 7.4.3 To distinguish different types of arrangements in which flowers may appear. 7.4.4 To compare an aquatic plant to a land plant. 7.4.5 To associate various flowering plants with their foliage. 7.4.6 To recognize the patterns in which leaves are arranged. 7.4.7 To classify tree-leaves according to common properties. 7.4.8 To describe in his own words the development of a leaf from bud to unfurling. 7.4.9 To identify the principal parts of a plant cell.	Root, stem, leaf, flower, fruit. Stamen, pistil, ovary. Single; clusters (spike, head, panicle, catkin, etc.) Alternate, opposed, whorled. Colouration, shape, dentition, vein pattern, length of petiole (stalk). Membrane, protoplasm, nucleus.

2nd cycle	1st cycle	Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
*	-	7.5 To describe in his own words the types of plants in his environment.	-	*	7.5.1 To identify different plant species in his environment at different seasons. 7.5.2 To distinguish perennial plants from annual plants. 7.5.3 To identify plants used for food and the part(s) which are consumed. 7.5.4 To classify plants in his environment according to common characteristics. 7.5.5 To describe the shapes of trees. 7.5.6 To identify the various means of plant propagation.	Examples of trees, shrubs, flowering plants, mosses.  Root, tuber, stem, leaf, fruit.  Colour, size, location, mode of reproduction, class.  Form: spherical, conical, plumed.  Via seeds, spores, cuttings (leaf, root, stem), layering (regular, air), by division, by grafting.
*	-	7.6 To describe in his own words some of the relationships between plants and the physical world	*	*	7.6.1 To discover and define by means of an experiment the ambient conditions which affect the germination and growth of a flowering plant. 7.6.2 To discover and define by means of an experiment the ambient conditions which affect the development of a plant population. 7.6.3 To discover the effects of plant life on a given physical environment.	Water (quantity, quality), temperature (maximum, minimum), light (quantity), soil (fertilizers).  Idem.  Beauty, cool, raise humidity, slow erosion, purify air, provide organic waste.

	2nd cycle	1st cycle	Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
	*		7.7 To describe in his own words the interrelationships between plants.	*		7.7.1 To identify the types of interrelationships between plants of the same species.	Competition, reproduction.
	*		7.8 To describe in his own words some of the relationships between man and plants; to identify some of the ways in which these relationships affect the environment.	-		7.7.2 To identify the types of interrelationships between plants of different species.	Parasitism, shelter (trees protecting flowering plants).
	*		7.9 To identify ways in which the actions he is taking to preserve and protect plant life will benefit the environment.	-		7.8.1 To identify some of the ways in which man uses plants.	Food, shelter, clothing, recreation, transportation.
				-		7.8.2 To identify the actions taken by man to protect and improve the flora.	Reforestation, battles against parasites, creation of parks, fertilization.
	*			-		7.9.1 To carry out his own plant life conservation activities.	
	*			-		7.9.2 To plan plant life protection projects in his environment, and to take appropriate follow-up action, where feasible.	

### 8.0 General Objective

To become familiar with the animal world and its inter-relationships with other living things and the physical environment; to develop responsible attitudes and behaviours toward this resource.



1 <sup>st</sup> cycle	1 <sup>st</sup> cycle	2 <sup>nd</sup> cycle	Intermediate Objectives	Related Content
•	8.1 To identify some of the characteristics of animals and the links which exist between himself and animal life.	•	8.1.1 To use drawings or diagrams to record observations of animal life in his environment. 8.1.2 To compare his own growth pattern with that of an animal he knows or has raised. 8.1.3 To express some of the feelings and impressions experienced during animal life identification activities. 8.1.4 To recognize that animals need an appropriate environment if they are to survive.	
2 <sup>nd</sup> cycle				

1 <sup>st</sup> cycle	2 <sup>nd</sup> cycle	Terminal Objectives	1 <sup>st</sup> cycle	2 <sup>nd</sup> cycle	Intermediate Objectives	Related Content
•	•	8.2 To compare the stages of development in animals in his environment with the stages of development in man.			<p>8.2.1 To describe in his own words the development of a small mammal.</p> <p>8.2.2 To describe in his own words the development of a bird.</p> <p>8.2.3 To describe in his own words the development of a fish.</p> <p>8.2.4 To describe in his own words the development of an insect.</p>	<p>Ovum, embryo, fetus, young, adult.</p> <p>Ovum, egg, nestling, adult.</p> <p>Ovum, egg, fry, adult.</p> <p><i>Complete metamorphosis</i>: egg, larva, (caterpillar, maggot), nymph (cocoon, pupa, chrysalis), adult.</p> <p><i>Incomplete metamorphosis</i>: egg, larva, adult.</p> <p><i>Without metamorphosis</i>: egg, adult.</p>
•	•	8.3 To describe the external characteristics of animals in his environment.			<p>8.3.1 To identify the external parts of a small mammal on an outline drawing he has made.</p> <p>8.3.2 To identify the external parts of a bird on an outline drawing he has made.</p> <p>8.3.3 To identify the external parts of a fish on an outline drawing he has made.</p> <p>8.3.4. To identify the external parts of an insect on an outline drawing he has made.</p>	<p>Ears, eyes (placement, colour), feet (manner of movement), tail, mouth.</p> <p>Beak (shape, use), feet (shape, use), plumage.</p> <p>Fins (number, placement), tail (shape), mouth.</p> <p>Eyes (number, size), feet, wings (placement, number, hardness,) mouth (manner of feeding).</p>

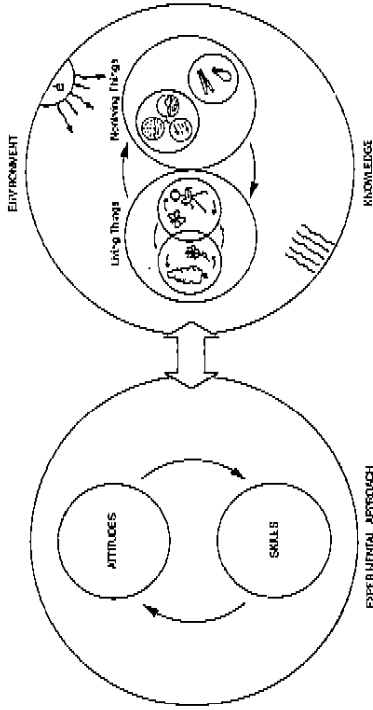
Terminal Objectives		1 <sup>st</sup> cycle	2 <sup>nd</sup> cycle	Intermediate Objectives	Related Content
1 <sup>st</sup> cycle	1				
2 <sup>nd</sup> cycle	*				
	8.4 To demonstrate that he knows his own body.	—	*	<p>8.4.1 To identify the principal parts of his body.</p> <p>8.4.2 To measure his size and mass; to use a histogram to show his growth during the year.</p> <p>8.4.3 To measure the circumference of his chest at maximum inspiration and expiration.</p> <p>8.4.4 To measure his biceps at work and when relaxed.</p> <p>8.4.5 To determine his pulse rate.</p> <p>8.4.6 To measure his body temperature.</p> <p>8.4.7 To calibrate a simple apparatus to measure lung capacity and use it to measure his own lung capacity.</p> <p>8.4.8 To determine by means of an experiment some of the limits of vision, hearing, smell and touch.</p> <p>8.4.9 To recognize the principal parts of an animal cell.</p>	The principal external and internal parts of the human body.
	8.5 To describe in his own words different animals in his environment.	—	*	<p>8.5.1 To make an inventory of the animals that share his environment.</p> <p>8.5.2 To classify these animals according to common properties.</p>	<p>Epithelial cell: membrane, protoplasm, nucleus.</p> <p>Colour, size, shape, habitat, eating habits, means of movement, means of reproduction, vertebrates, invertebrates (and sub-classes).</p>
1 <sup>st</sup> cycle	1				
2 <sup>nd</sup> cycle	*				

Terminal Objectives		1 <sup>st</sup> cycle	2 <sup>nd</sup> cycle	Intermediate Objectives	Related Content
1 <sup>st</sup> cycle	8.6	To describe in his own words some of the interrelationships that exist between the physical environment and animals (including man).		8.6.1 To discover how an animal such as a small mammal, bird, fish, or insect adapts to its environment.	Hair (fur), plumage, scales, fins, number and shape of feet, shape of tail and mouth.
2 <sup>nd</sup> cycle			*	8.6.2 To discover and define by means of an experiment the ambient conditions necessary for the growth of an animal (including himself).	Habitat, water, air, temperature, light.
			*	8.6.3 To discover some of the ambient conditions necessary for the growth of an animal population (including a human population).	Idem.
			*	8.6.4 To recognize the effects of animals on a given physical environment.	Scavenger, aeration of soil, balance of life.
			*	8.6.5 To describe in his own words how the physical environment influences man.	Limits his movements, style of clothing, health, settlement, and influences his disposition.
	8.7	To describe in his own words some of the interrelationships that exist between animals.		8.7.1 To identify relationships between animals of the same species (individuals or populations).	Socialization, sexual relations, competition.
2 <sup>nd</sup> cycle			*	8.7.2 To identify relationships between animals of different species (individuals or populations).	Prey-predator, parasitism, mutualism, commensalism, herbivore, carnivore, food chain.
1 <sup>st</sup> cycle	8.8	To describe in his own words some of the interrelationships that exist between plants and animals.			Parasitism, shelter, food chain, pollination, herbivore.

	Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
1st cycle					
2nd cycle	<p>8.9 To describe in his own words some of the relationships that exist between man and animals; to identify some of the ways in which these relationships affect the environment.</p> <p>8.10 To identify ways in which the actions he is taking to preserve and protect animal life will benefit the environment.</p>	-	*	<p>8.9.1 To identify some of the ways in which man uses animals.</p> <p>8.9.2 To identify man's actions to protect and improve animal life.</p> <p>8.10.1 To carry out his own animal life protection activities.</p> <p>8.10.2 To plan animal life protection projects in his environment, and to take appropriate follow-up action, where feasible.</p>	<p>Food, clothing, shelter, transportation, recreation, energy.</p> <p>Creation of parks and clubs, battles against parasites, laws regulating hunting and fishing.</p>

## 9.0 General Objective

To become familiar with water and its interrelationships with the other elements of the environment to develop responsible attitudes and behaviour conducive to rational use of this resource and the benefits man gains from it.

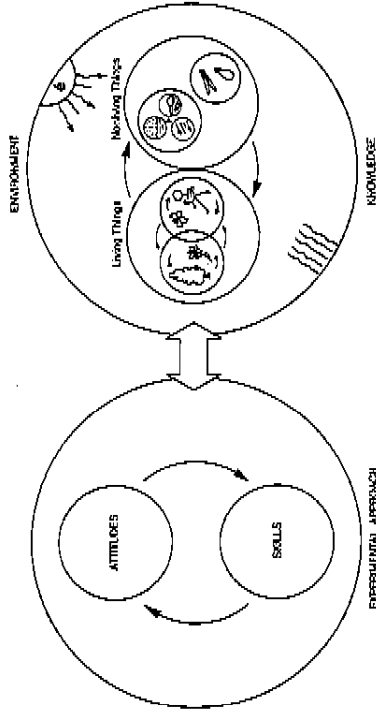


Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
9.1 To describe in his own words what water is and the links that exist between himself and water.	*		9.1.1 To recognize water in its different forms.	Water (hot, tepid, cold), ice, steam, rain, snow, hail, sleet, rime (hoarfrost), dew.
	*		9.1.2 To describe his sensations and impressions as he observes and handles water in different forms.	
	*		9.1.3 To identify techniques invented by man to use water, to reproduce at least one of them.	Boat, lock and canal, dam.
	*		9.1.4 To demonstrate, using concrete examples, how water satisfies his own needs.	Life, hygiene, healing, transportation, work, energy, recreation.
9.2 To compare the properties and characteristics of water with those of other liquids.	*		9.2.1 To discover, through the use of his senses, some properties of water.	Colour, odour, form, taste.
	*		9.2.2 To discover, through the use of appropriate equipment, some properties and characteristics of water	Mass, fluidity, solubility, surface tension, capillary action, viscosity, freezing point, boiling point, expansion, contraction, saturation point.
9.3 To recognize the different forms and states in which water is found in his environment	*		9.3.1 To measure the amount of precipitation (rain and snow) in his area during a given period.	Rain (rain gauge).

Terminal Objectives		1st cycle	2nd cycle	Intermediate Objectives	Related Content
1st cycle				9.3.2 To compare the densities of different layers of snow.	
		*	*	9.3.3 To recognize the presence of water vapour in air.	Steam, dew, rime (hoarfrost), fog.
		*	*	9.3.4 To describe rain in his own words.	Water cycle, types of clouds (nimbus, cumulus, stratus, cirrus).
		*	*	9.3.5 To demonstrate the presence of water in soil.	States of water (solid, liquid, gas).
		*	*	9.3.6 To demonstrate that, in nature, water is present in different states as an effect of energy.	
2nd cycle	9.4 To identify some of the ways in which man uses water; to know how these uses affect the environment.	-	*	9.4.1 To identify some of the ways in which man uses water.	Life, hygiene, shipping, dams, docks, canals, transportation of wood, sewage, hydro-electric plants.
			*	9.4.2 To identify actions taken by man to protect and improve the quality of water.	Filtration plants, water meters, reforestation of river banks, reduced use of water for dumping of raw sewage, rational use of hydro-electric power.
			*	9.4.3 To identify actions taken by man to ensure a more rational use of hydro-electric power.	Controlled use of electricity during peak hours (5:00 to 7:00 p.m.), appliances that use less electricity, better insulation in buildings.
1st cycle				9.5.1 To carry out actions conducive to a more rational use of water resources and the energy drawn from them.	
2nd cycle	9.5 To identify the ways in which the actions he is taking to protect water and make more rational use of hydro-electric power will benefit the environment.	-	*	9.5.2 To plan projects for the protection of water quality in his environment, and the energy water provides, and to take appropriate follow-up action, where feasible.	

## 10.0 General Objective

To become familiar with air and its interrelationships with other elements of the environment; to develop responsible attitudes and behaviours conducive to rational use of this resource.

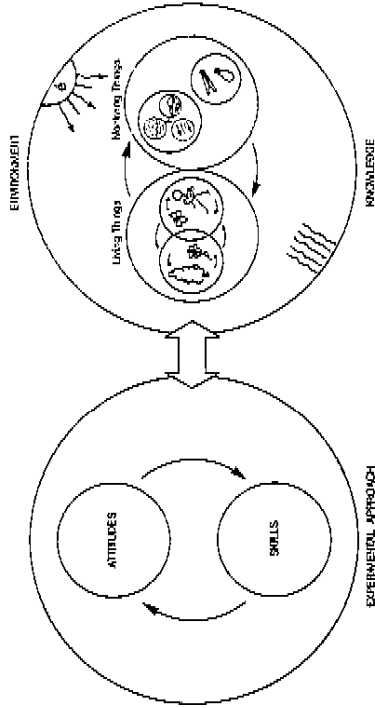


Terminal Objectives		1st cycle	2nd cycle	Intermediate Objectives	Related Content
•	10.1 To describe in his own words what air is, and the links that exist between himself and air.	•		10.1.1 To express his feelings and impressions as he observes different manifestations of air.	
		•		10.1.2 To express what he feels during experiences with objects which function by the use of air.	
		•		10.1.3 To identify objects and techniques which function by the use of air; to develop a model of at least one of these.	Suction cup, siphon, various pumps, whirrig, parachute, kite, glider, airplane.
		•		10.1.4 To demonstrate, using concrete examples, how air satisfies his personal needs.	Life, hygiene, comfort, transportation, energy, recreation.
		•		10.2.1 To describe "wind" in his own words.	Moving air.
	10.2 To recognize signs of the presence of air in his environment.	•		10.2.2 To use appropriate instruments to demonstrate that air is always in motion.	Weather vane, anemometer, parachute, kite, glider.
			•	10.2.3 To demonstrate the presence of air by the effects of air pressure.	Metal container, heated and sealed, crushed by air pressure on cooling, siphon.
			•	10.2.4 To demonstrate the presence of air other than that of the atmosphere.	In water and soil.

Terminal Objectives		1st cycle	2nd cycle	Intermediate Objectives	Related Content
1st cycle	—	—	•	10.3.1 To determine some of the properties and characteristics of air through the aid of his senses.	Colour, odour, form, air resistance.
2nd cycle	•	•	•	10.3.2 To determine some of the properties and characteristics of air through the use of instruments.	Mass, air pressure, air resistance, effect of heating, components of air (oxygen, water vapour, dust, carbon dioxide, nitrogen, rare gases).
1st cycle	—	—	•	10.4.1 To identify some of the ways in which man uses air.	Life, transportation, heat, energy.
2nd cycle	•	•	•	10.4.2 To identify man's efforts to protect and improve the quality of the air he breathes.	Improvements made to filtration systems which gather particles emitted by industry, catalysts.
1st cycle	—	—	•	10.5.1 To carry out activities demonstrating a rational use of air.	
2nd cycle	•	•	•	10.5.2 To plan air quality protection projects in his environment, and to take appropriate follow-up action, where feasible.	

## 11.0 General Objective

To become familiar with soil and its interrelationships with other elements of the environment; to develop responsible attitudes and behaviour conducive to a rational use of this resource and the benefits man gains from it.

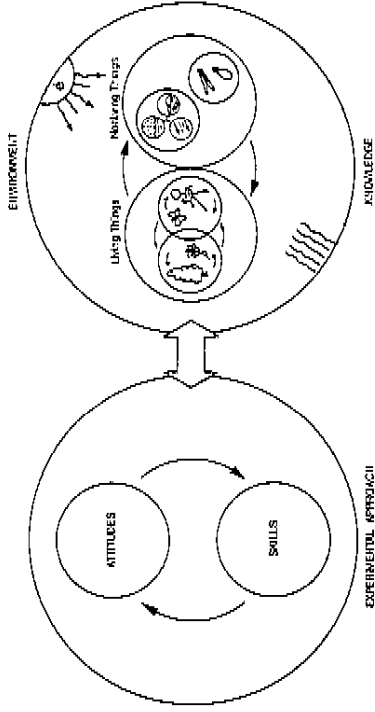


Terminal Objectives		1st cycle	2nd cycle	Intermediate Objectives	Related Content
1st cycle	*				
2nd cycle		*		11.1.1 To describe his feelings and impressions as he handles the various components of soil.	Sand, clay, rocks, minerals.
		*		11.1.2 To express what he feels during identification activities with the elements of soil.	
		*		11.1.3 To make various objects employed by man, using soil.	Sandpaper, ceramics, lime, sandstone grinding wheel, concrete.
		*		11.1.4 To demonstrate, using concrete examples, how soil serves his own needs.	Life, hygiene, filtration, agriculture, mines, housing, recreation.
		*	*	11.2.1 To discover some of the properties and characteristics of arable soil.	Workable (fillable), porous, supports life.
		*	*	11.2.2 To discover some of the properties and characteristics of rock.	Dense, mass, source of minerals, base of continents.
		*	*	11.3.1 To distinguish the principal components of arable soil; to compare them with those of another type of soil.	Water, air, plant, animals, microorganisms, rocks.

Terminal Objectives		1st cycle	2nd cycle	Intermediate Objectives	Related Content
1st cycle					
2nd cycle					
1st cycle	11.4 To describe in his own words some of the ways in which man uses soil; to recognize the effect of these uses on the environment.	-	*	11.3.2 To discover the similarities and differences between different types of soil. 11.3.3 To identify the different constituents of a rock; to compare these with those of a different type of rock 11.3.4 To discover similarities and differences between different rocks. 11.4.1 To identify some of the ways in which man uses soil. 11.4.2 To identify man's efforts to protect and improve soil quality. 11.4.3 To identify man's efforts to encourage a rational use of soil energy.	Density, colour, texture, odour. Minerals, fossils. Texture, odour, hardness, form, colour, volumetric mass, magnetism, permeability, conductivity, transparency, opaqueness, translucence. Agriculture, mines and energy sources, developments, road systems, refuse dumps, construction. Agricultural zoning, laws controlling refuse dumps. Production quotas, lighter vehicles, improved building insulation.
2nd cycle					
1st cycle	11.5 To identify the ways in which the actions he is taking to make more rational use of soil and soil energy will benefit the environment	-	*	11.5.1 To carry out actions conducive to a rational use of soil and the energy from it. 11.5.2 To plan projects for the preservation of soil quality in his environment, and the energy from it, and to take appropriate follow-up action, where feasible.	

## 12.0 General Objective

To become familiar with manufactured products; to develop responsible attitudes and behaviour conducive to rational use of manufactured products.



Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
12.1 To show similarities and differences between nonliving things and living things.	*	*	12.1.1 To identify the characteristics of living things.	Individuality, complex organism, ability to move, to feed, to reproduce, vulnerability, respiration, behaviour related to its environment, mortality.
12.2 To identify some of the ways in which man transforms natural substances to create products.	*	*	12.1.2 To identify the characteristics of nonliving things.	No individuality, lack of organized structure, inability to move, to feed, to grow, to reproduce.
		*	12.2.1 To distinguish between natural and manufactured products.	Animal, vegetable, and mineral substances.
		*	12.2.2 To recognize the presence of animal, vegetable, and mineral components in products.	Wooden furniture, leather goods, sculpture.
		*	12.2.3 To give examples and explanations of simple transformations which man carries out on natural substances to create manufactured products; to make one of these products.	Plastic toys, paper, lipstick, high technology.
		*	12.2.4 To give examples and explanations of radical transformations carried out on natural substances to create manufactured products; to reproduce one of these.	

1st cycle	2nd cycle	Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
	*	12.3 To list some properties of manufactured goods.	*		12.3.1 To use his senses to determine some properties of manufactured products.	Colour, shape, lustre, transparency, opacity, translucency, texture (smooth, rough, hard, soft, rigid, supple, elastic, brittle, crumbly, sticky, slippery), sound (shrill, deep), odour, taste, (bitter, tart, mild, sweet, salty).
	*	12.4 To identify and produce manufactured products formed from simple machines; to identify the components of these systems and how they interact.			12.3.2 To use instruments to determine other characteristics of manufactured goods.	Mass, volume, size, conductivity, magnetism, inflammability.
	*				12.4.1 To construct simple machines; to identify their components and how they interact.	
	*				12.4.2 To build a simple pendulum; to identify its component parts and how they interact.	
	*				12.4.3 To recognize systems whose elements interact at a distance; to identify these elements and how they interact.	Magnets, static electricity.
	*				12.4.4 To develop a model to outline the functioning of a simple system.	
	*				12.4.5 To identify sources of energy for motion in a simple system.	Sources of muscular, electrical, and magnetic energy.

	1st cycle	2nd cycle	Terminal Objectives	1st cycle	2nd cycle	Intermediate Objectives	Related Content
		*	12.5 To build and use diagrams to represent an electric circuit; to discover how the different elements of the system interact.		*	12.5.1 To discover the properties of battery cells and light bulbs. 12.5.2 To connect light bulbs and battery cells in series; to draw a diagram of the circuit. 12.5.3 To connect light bulbs and battery cells in parallel; to draw a diagram of the circuit. 12.5.4 To discover, by means of experiments, what substances are conductors of electricity; to use a conductor to close a break in a circuit. 12.5.5 To determine by means of experiments, which substances are insulators. 12.5.6 To build a simple on/off switch for an electric circuit. 12.5.7 To identify changes in the conductivity of a circuit when a wire is replaced by one which is thicker or thinner than the previous one, or by a poorer conductor, or when the length of the wire is increased. 12.5.8 To explain the use of switches and insulated wire.	Energy, light, heat.
		*	12.6 To identify the energy needs for the manufacture of products.		*	12.6.1 To identify the forms of energy needed for manufacturing in at least one case involving a simple transformation. 12.6.2 To identify the forms of energy needed for manufacturing in at least one case involving a radical transformation.	Open circuit, closed circuit, insulation. Muscular, mechanical, electrical, or heat energy. Electrical, chemical, or nuclear energy.
		*	12.7 To describe in his own words some of the ways in which man uses various products manufactured in his environment. To recognize the effect of these uses on the environment.	-	*	12.7.1 To discover the ways in which man uses manufactured products sensibly. 12.7.2 To discover the ways in which man uses manufactured products in a way detrimental to the environment.	Conservation: maintenance, repair, recycling. Pollution: soft drink cans, tires, newspapers discarded just about anywhere.

Terminal Objectives		1st cycle	2nd cycle	Intermediate Objectives	Related Content
1st cycle	1				
2nd cycle	*				
1st cycle	12.8 To identify the ways in which the action he is taking to preserve the rational use of manufactured products will benefit the environment	1		12.8.1 To carry out actions conducive to a rational use of manufactured products. 12.8.2 To plan projects for the preservation of manufactured products in his environment, and to take appropriate follow-up action, where feasible.	
2nd cycle	*	*	*		

## IV. EVALUATION

### A. Outline

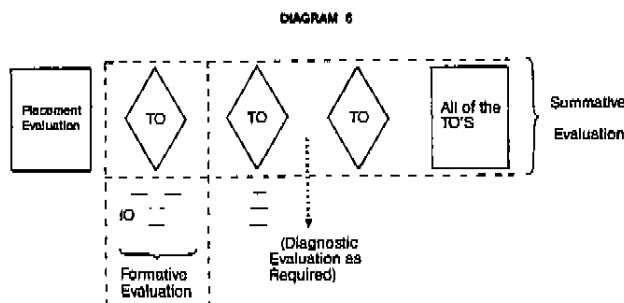
There are two types of decisions which the teacher must make from time to time in the practice of evaluation: administrative decisions and educational decisions. The first type of decision is made on the basis of norms, by comparing the performances of all of the pupils for purposes of selecting, placing and promoting. This is norm-referenced interpretation of measurement data. The second type of decision is related to the pupils' day-to-day performance and allows the teacher to modify his instructional approach in accordance with the pupils' progress. These decisions are made at the end of learning activities and are criterion-referenced interpretation of measurement data.

### B. Measurement: The First Step in the Evaluation Process

*Measurement* is different from *evaluation* in that it provides the information on which judgements will be made, whereas evaluation is the process of making the judgements on which decisions will be based.

There are two ways in which measurement may be effected. Norm-referenced interpretation of measurement data provides a score which is used to compare the pupil's performance with that of other pupils in his group. It serves to support norm-referenced evaluation. Criterion-referenced interpretation of measurement provides a score which is compared with the level of mastery expected for one or a number of behaviours encompassed by specific objectives. It may encourage the making of an individual chart for recording each pupil's progress in developing attitudes and skills, and in acquiring knowledge. Criterion-referenced interpretation supports formative and summative evaluation. Two other uses of evaluation may supplement the ones outlined above to provide a system of continuous evaluation. The first is **PLACEMENT** evaluation which is a type of initial evaluation used to assess the pupil's level of competence before introducing a new learning unit. The second is **DIAGNOSTIC** evaluation which is made to determine the underlying causes of any difficulties encountered as learning takes place.

This information should be sufficient to enable those who are interested to put into practice all the component parts of the evaluation model suggested by the Direction d'évaluation pédagogique, as shown in the following diagram:



This evaluation procedure allows the teacher to get to know the pupil and to follow his progress. It also enables him to compare his pupils' performance to an external norm and, when necessary, to modify his teaching strategies to help pupils make more satisfactory progress.

### C. Evaluation in Natural Science

Given the nature of the goals of this Natural Science program, the two types of evaluation which merit priority consideration are summative evaluation and criterion-referenced evaluation.

With summative evaluation, it is possible to ascertain the extent to which a set of terminal objectives has been attained. It is effected at the end of sequences of learning of varying length and may be used to make a sort of balance sheet of pupils' achievements. In natural science, criterion-referenced interpretation should be used to assess the degree of competence the pupil has achieved in using the experimental approach, which encompasses attitudes and skills, and the degree of commitment the pupil has towards conservation of the biosphere's resources. The evaluation model described here should make it possible:

- to supply the pupil with information about his performance in relation to the objectives set at the beginning so that he can follow his own progress toward these objectives.
- to furnish the teacher, parents, and the pupil with information about the pupil's progress in reaching all of the program's objectives, with a view to suggesting, when necessary, ways which might help him to make more satisfactory progress. Evaluation requires cooperative effort from those responsible for education and is an integral part of the learning process.

The evaluation process should take into account everything which affects the educational process: concept attainment, methodological improvements, changes in attitude, classroom atmosphere, and so on.

### D. Selection of Measurement Instruments

Teaching is based on a program or course presented in terms of objectives which comprise attitudes, use of the experimental approach, and knowledge to be acquired by the pupil. A wide range of instruments is available to measure the knowledge acquired by pupils. There are also a number of specialists in the development of tests for this purpose. These tests may take different forms: written, oral, theoretical, practical, partial, final, individualized, common, objective-type, and free-response-type. Teachers are familiar with these types of measurement instruments.

It is more difficult to obtain or make up instruments designed to help the teacher evaluate the degree of development of attitudes and skills. There are, of course, rating scales for practical performance, progress reports, self-evaluation forms, and observation checklists which are of some help to teachers. It is acknowledged, however, that there is a scarcity of instruments in the area of attitude and skill evaluation. The Curricu-

lum Guide offers some suggestions which should be of help to the teacher until such time as the results of research currently underway in various universities are available.

### **E. Who Should Evaluate?**

Progress in attaining the objectives of the Natural Science program may be evaluated by the teacher, the pupil himself in some cases, or externally, providing the proper instruments are used so that the most objective evaluation possible will be made of the attitudes, skills, and knowledge acquired by each child in the class, or by the whole class, during the Natural Science courses.

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