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THE DEVELOPMENT OF AN ENVIRONMENTAL SCIENCE COURSE FOR PRIMARY SCHOOLS, GRADES 1 - 7 IN ZIMBABWE RHODESIA

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THE DEVELOPMENT OF AN ENVIRONMENTAL SCIENCE COURSE FOR
PRIMARY SCHOOLS, GRADES 1-7 IN ZIMBABWE RHODESIA

by

Irma Acosta Allen

A Dissertation Submitted to the Faculty of the
DEPARTMENT OF SECONDARY EDUCATION
In Partial Fulfillment of the Requirements
For the Degree of
DOCTOR OF PHILOSOPHY
In the Graduate College
THE UNIVERSITY OF ARIZONA

1980

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As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Irma Acosta Allen entitled The Development of an Environmental Science Course for Primary School, Grades 1-7 in Zimbabwe Rhodesia and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

Mark Smith
Date: January 30, 1980

Paul M. Allen
Date: Jan. 30, 1980

[Signature]

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

Robert J. Letson
Dissertation Director
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SIGNED: James A. Allen
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love for education and an appreciation of the variety of life in this wonderful, complex world.
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ABSTRACT

A study was made to determine the environmental education needs of Rhodesian African primary school pupils and procedures for meeting those needs within the framework of an Environmental Science Course which would complement an Environmental Social Studies Course.

Procedures used to investigate the needs and ultimately determine the scope, aims, methods, and materials for the course were: (1) two questionnaires to stratified samples of education officers, supervisors, headmasters, and teachers—the first to 168 and the second to 504; (2) a questionnaire and interviews with local professional environmentalists; (3) classroom observation and trial teaching of lesson units, as they were developed, across a broad spectrum of schools; (4) an informal survey of the activities and materials produced by agencies and organizations concerned with environmental issues; (5) review of currently existing geography, science, and gardening courses and materials; (6) meetings with provincial education officers, headmasters, and supervisors; (7) meetings with teacher trainers in three major teacher training institutions in the country; and (8) reference to pertinent literature.

Results of the questionnaires provided the basis for the topic content of the course, and defined the major areas of concern as being: natural resources, agriculture, the natural physical environment, the man-made physical environment, health, and body systems.
Areas emerging from the study which required special attention were: language, traditions, limited physical resources, introduction of new teaching-learning approaches, rural nature of 90% of the schools, terminal aspect of primary education for roughly 80% of the pupils, communication of the teacher-learner strategy, large proportion of teachers with minimum training, and meeting national needs and aspirations in a time of war.

The main outcome of the study was a curriculum plan for an Environmental Science course whose broad aims are to: (1) make pupils aware of the ecological inter-relationship of the physical and biological factors that make up the environment, and of man's relationship to it; (2) motivate pupils to responsible action toward better management of the environment so as to ensure survival and improve the quality of life; (3) provide pupils with basic skills and concepts in science, gardening, and geography; and (4) foster the development of positive interests, attitudes, and aesthetic awareness of the environment.

The components of the system are presented, as well as a scheme, tentatively incorporating 50 lesson units. Recommendations regarding the learning objectives (content, concepts, skills, attitudes) teaching approaches, instructional materials, pacing, the role of the participants, and pupil assessment procedures are given.

The curriculum plan, as presented, was approved by the Ministry of Education for further development and eventual implementation into the schools of the country. Recommendations are made for the next phase of the project. These emphasize the development and evaluation of
instructional materials, establishment of teacher training programs, and evaluation of the curriculum.
CHAPTER 1

INTRODUCTION

"Curriculum development happens in a context" (Hawes, 1977, p. 145). It is imperative that it takes cognizance of the character of the national community, of the economic circumstances, the social situation, the schools, the children, the times. To this effect, background information of the country, and the state of its curriculum development is presented.

Background

Rhodesia, a country which encompasses an area of 390,757 square kilometers between the Limpopo and Zambezi Rivers, presents a very interesting and unique setting for educational research and development due to several factors.

First, Rhodesia cannot be classified as a typical developing (or low income) country, nor as an industrialized (or high income) one. It really is what some authors now refer to as a transitional country, one which has built up over the years, an infra-structure of education at different levels, research institutes and industry, even though the major part of the population is still living on a low income.

Secondly, it has been the subject of external sanctions of some kind or another (boycotted by many countries) for over 13 years.

1. The name is now Zimbabwe Rhodesia, but at the time of this study it was Rhodesia.
Aside from economic implications, this means that many international agencies who would probably be providing aid and be involved in some of the development programs, e.g., UNESCO, AID, FAO, etc., are not in the country. This has presented an extra responsibility on governmental, religious, and social organizations for education and community development.

Thirdly, up to the present time the Ministry of Education has administered all education in the country under two Divisions, one dealing with European, Asian, and Colored education, and the other wholly with African education. This has resulted in a diverse system.

The background of the teachers and pupils is quite varied. White Rhodesians represent most of the European cultures, although the greater part by far have South African or British origin. There are small groups of persons of Asian (mainly Indian) ancestry and persons of mixed blood (coloured). The indigenous people are of Bantu origin, the main tribes being the Mashona and the Ndebele, with the largest proportion being Mashona. There are widely differing life styles between the rural and urban components of this population.

Another important aspect is that the country has been at war for the last thirteen years. The struggle for majority rule is being fought along several fronts, from the armed encounters with externally based guerillas, to internal struggles for a greater say in charting the course of African life and education. Any development or research being carried out has to take cognizance not only of the physical dangers which such a situation creates, but even more important
(because these are not so obvious) of the changing tides of public opinion and national needs.

In 1974, a Committee of Enquiry into African Primary Education (Grades 1-7) was established and headed by Professor L. J. Lewis and Professor A. Taylor of the University College, Wales. This committee recommended that four components of the existing primary school curriculum, i.e., geography, history, science, and gardening, should be given new emphasis and presented as two interrelated subject areas, one to be called "Environmental Studies: Social" and the other, "Environmental Studies: Physical," the former focusing on human interrelationships and the latter on the development of better understanding of the interdependence of man and nature and of man's need "to use natural resources with proper balance between their exploitation, maintenance and conservation" (Rhodesia, 1974, p. 14).

To further this aim, the Secretary for African Education set up in July, 1977 an Environmental Education Committee consisting of education officers from the African Division of the Ministry of Education and staff from the Science Education Center of the Faculty of Education of the University of Rhodesia. Professor Peter Gilbert, Director of the Science Education Center, was appointed chairman of the committee. Their brief was to formulate and recommend to the Secretary for Education a primary school syllabus for the new subject area Environmental Studies.

Initially, the Committee was faced with major issues such as the determination of the position of an Environmental Studies course in the primary school curriculum and the specification of the scope
and objectives of the course for Rhodesian African primary schools. In these respects, the Committee decided on the following:

1. To aim, initially, for the formulation of an Environmental Studies Course which would replace the current areas of geography, history, science, and gardening from Grades 1 to 7.

2. To recommend the establishment of two Working Parties. One would develop a curriculum for Environmental Studies: Social (concerned with the human and social aspects) and the other would develop a curriculum for Environmental Science. These two Working Parties would be under the direction and coordination of a steering committee of the Environmental Education Committee.

3. To accept provisionally the objectives stated in the Lewis/Taylor Report, anticipating an elaboration of these objectives from the activities of the Working Parties.

This particular study concerns the investigations and activities of the Environmental Science Working Party. It was appointed by the Environmental Education Committee, and consisted of 3 members: a lecturer from the Science Education Center of the University of Rhodesia; a teacher seconded from the Ministry of Education; and a faculty research fellow from the Science Education Center of the University of Rhodesia, who is the author of this report.

Although this study was concerned with the development of an Environmental Science curriculum for African primary schools in Rhodesia, it must be seen within the context of curriculum development
in Africa, particularly within the context of primary science curriculum development.

**Primary Science Curriculum Development in Africa**

The sixties saw a tremendous move toward curriculum change in Africa. The newly independent countries saw education as a positive and vital force in developing an educated populace and a professional manpower source. New roles for independent people were emerging, and there was a desire to control the structure and direction of education.

Fafunwa (1971, p. 6) of the University of Ife, in Nigeria expressed a widely felt sentiment as follows:

> No country in Africa, south of the Sahara and north of the River Limpopo, can claim to have escaped the imposition of the colonial system of education upon its people. The French, the British, the Portuguese, the Germans and the Spaniards left behind the educational legacies of their respective countries. This is of course understandable as a historical phenomenon in that there is always an insatiable desire on the part of an imperial power to impose its own culture on a colonial people whether that power be Roman, Greek, Arab, French, British or African. Because of the multiplicity of approaches and the differing objectives of general or special education as revealed in each of the cosmopolitan countries, the continent of Africa is a polyglot of divergent and conflicting educational systems and practices. Worse still, many African countries still pursue the inherited system years after the country of origin had abandoned or drastically modified its own system to suit its changing economy.

Another prevailing belief was that there existed a direct relationship between education and economic progress (Atkinson, 1974). This was debatable, but nevertheless, it caused education to be a matter of interest not only to the educationist, but also to the national leaders as well.
New pedagogies were welcomed as instruments of change. There was a desire for more relevance and localization, and for modern approaches. There was also pressure in the form of foreign aid for educational development.

A most important step in environmentally oriented primary science curriculum development was the African Primary Science Program (APSP). This program was established as an effort to upgrade the teaching of science at the primary level in the schools of English-speaking tropical Africa. It was designed to learn whether new methods and materials being adopted in the United States and Western Europe could be adapted to the needs of developing countries. Sponsored by American International Development (AID), and largely directed by Educational Development Corporation (EDC), the program advocated a discovery-type approach to learning, emphasized active pupil participation and first-hand experience with learning situations relevant to the stage of development and to the ability of the individual.

The research and development phase of the program lasted from 1965 to 1971. An important aspect of this phase was the establishment of science centers in strategically located countries in various parts of the continent. These were bases for the local adaptation of materials produced at Pan-African workshops. The centers provided for local modifications for local priorities and were established to meet an on-going need of developing and testing new ideas to keep pace with science advancement. Seven centers were established. These were located in Kenya, Nigeria, Ghana, Malawi, Tanzania, Sierra Leone, and
Uganda. Each of the centers was associated with either a Ministry of Education, an Institute of Education, or a University.

The body of teaching materials developed were seen as curriculum building blocks, easily adaptable to the needs of each of the participating countries. They fell into the categories of teachers' guides, pupils’ books, science library readers, mini-units, and teachers' background books. In addition to the development of teaching materials, the science centers became resource centers, collecting materials for the construction of simple apparatus, and reference materials and books.

From July 1971 to June 1976, the major implementation phase of the program took place, and this was focused on five countries (Sierra Leone, Ghana, Kenya, Tanzania, and Uganda) under the sponsorship of USAID's Bureau for Africa. The objective of the program was to promote curricular reform and new approaches to teaching primary science, and this was accomplished through:

1. The development at workshops of materials for tutors to use in their courses in the 151 participating teacher training colleges, the training of the tutors in their use, and assistance to tutors with their in-service training programs for primary teachers.

2. Upgrading staff members of curriculum development centers in participating countries through a special training program developed for this purpose.

3. Support to the Science Education Programme for Africa (SEPA), an African based and directed organization which ultimately
assumed complete responsibility for the leadership and co-
ordination of African science programs (Education Development
Center, 1976).

The development work for this program was conducted throughout all of
English-speaking tropical Africa, and at least 13 countries were
involved in some aspect of implementation and follow-up. As a result,
much valuable information on science curriculum development in Africa
was obtained.

Some interesting conclusions were presented as follows:

1. A clear distinction between the research and development phase
and the implementation phase did not conform to the realities
of Africa. All program development efforts in the partici-
pating countries took place because the governments were con-
sidering changing science teaching practices. Thus manpower
development was seen as the precondition for changing the
teaching of science in primary schools. In this respect the
research and development phase of APSP provided some oppor-
tunity for that manpower development to occur.

2. Five years is not a sufficient period of time to cope with the
magnitude of the retraining effort involved for any country's
full complement of primary teachers.

3. Although the efforts of the program introduced to Africa new
kinds of educational methods and materials using science as
the vehicle, its greater contribution was seen in helping
Africa shape its own future development through fostering
those institutions which lead that development and culminating in transfer to SEPA.

4. It was strongly felt that in the 70's programs attempting educational change orchestrated from abroad (replications of APSP) would be a mistake as African nations are generally averse to external imposition of ideas.

5. There was an increasing demand toward the integration of subject matter, and an awareness that curriculum change in a single subject area at the primary level may not be the best long term way to proceed. The introduction of environmental studies was suggested as a means of integrating subject matter at that level.

6. Although there was no formal evaluation during the implementation phase of the program, two independent reviews of APSP were carried out to see whether program development efforts were being sufficiently productive and whether specified programming targets were being met. The results were very supportive and concluded that although it would take years of study to ascertain accurately the effect of the program at the classroom level, there was little doubt that the program had caused a significant change in the nature of primary science education in almost half a continent (Education Development Center, 1976).

As a follow up to a UNESCO Workshop on Environmental Education held in Belgrade in 1975, and in preparation for the Intergovernmental
Conference on the same subject due to be held in Russia in 1977, UNESCO organized five regional meetings in different parts of the world. One was held, in collaboration with the University of Brazzaville, on September 11-16, 1976 at Brazzaville. Some twenty experts from different parts of the African continent were personally invited by the Director General of UNESCO to take part. The purpose was to provide an opportunity both to review the recommendations from the Belgrade Workshop in order to adapt them to African reality, and to advise UNESCO on possible strategies to be adopted for the region. Furthermore, this African Regional Meeting was expected to define the means required to promote environmental education in Africa, by coordinating resources (personnel, materials, equipment) (UNESCO, 1977).

Present environmental problems in Africa, such as overpopulation, pollution, traditional technology, and exhaustion of natural resources, were discussed. The adequacy of the present school systems to tackle environmental education was considered. Acknowledging some merits of the systems in general there were, however, serious criticisms of the colonial and post-colonial schooling system which now widely exists in Africa. Doubts were expressed that such a system can educate the masses for a better understanding of the African environment, and for its transformation for the benefit of the greatest number, because it encourages adoption of alien values and foreign cultural trends. Children often learn at school to feel contempt for traditional life. "The whole fabric of African life and civilization
According to the conference delegates, the prospects for environmental education, then, require that first it responds to the general needs of sensitizing the entire population, retraining senior and professional staff, and integrating a common environmental approach into the curricula. The need for keeping traditional education alive was seen. It was also stressed that the concept of environmental education must bring out that which is specifically African. The delegates concluded that the specific African features of environmental education must emerge clearly in the following measures and stages:

1. The rational use of material and human resources.
2. Development of the environment through viable land planning schemes.
3. Institutional education.
4. Attitudes and behavior conducive to improving the quality of life.

Finally, it was emphasized that the future prospects for environmental development suggest a possible reorientation of educational systems in Africa. This would require a reorganization of present syllabuses and subject matter taught, as well as retraining working teachers. Stronger links will have to be forged between school and community, and educational themes and teaching aids must be based on the components of the ecosystem in which those to be educated live. These prospects, however, could not be realized unless immediate large-scale environmental
education experiments were undertaken in different countries in the very near future (UNESCO, 1977, p. 12).

Rhodesia, although represented at one of the first Pan-African workshops in Kano in February 1965, was barred from further participation in the APSP program when it unilaterally declared independence on November 11, 1965. However, in 1967, the Science Education Centre at the University of Rhodesia under the direction of Professor Peter Gilbert, with a small staff headed by Mike Robson, undertook a major curriculum change project in African primary school science. The result is the Discovery Science program now being followed in the Rhodesian primary schools from Grades 1 through 5.

The course was planned in three stages from the point of view of child development. These were described by Robson (1977a, p. 190) as:

STAGE I  (Grades 1 & 2)  (Age range 6+ to 8+)
Perceptual Exploration
Collecting and communicating experience; exploring with the senses

STAGE II  (Grades 3 to 5)  (Age range 8+ to 11+)
Conceptual Exploration
Acquisition of various unifying ideas and scientific methods as "thinking tools" (i.e., properties, changes, measurement, symmetry, location, systems)

STAGE III  (Grades 6 & 7)  (Age range 11+ to 13+)
(This stage was not implemented)
Using various thinking tools and scientific methods to solve problems and extend understanding to the natural world.

This program aimed to teach science as a combination of big ideas (such as cycles, systems) and as a process of learning about the world. As with the APSP program it advocated a discovery-type approach
to learning and emphasized active pupil participation and first-hand experience.

Teacher's guides for each of the five grades were produced. From the beginning, the Discovery Science course was planned as a package aimed at teachers, with very detailed step-by-step lesson programs to get across the teaching approach. Later on, radio broadcasts were also integrated as part of the program.

The materials have now been in the schools for up to nine years, and some evaluation has been carried out. Thus it is possible to have feedback on this type of process-centered teaching.

Another curriculum project which has relevance to this study is a "mini" curriculum development exercise carried out by the Education Development Unit of the Ministry of Education (African Division) and introduced in 1976 to Grade 7 for use in the third term only (12 weeks) on the theme "Health and Home" (Warke, 1977). The curriculum was very much pupil-activity and project centered, and aimed to give pupils some preparation for the practical problems of living and a better understanding of their immediate environment.

An evaluation exercise carried out at the end of its first use in the schools showed that it was very well received by both pupils and teachers (Rhodesia, 1977).

This brief introduction to previous curriculum development projects in Africa and particularly in Rhodesia, which are of relevance and of value to new curriculum development work in Environmental Science brings us up to the present study.
Statement of the Problem

This study entailed carrying out an investigation to determine what the needs of the African primary school pupils are in terms of achieving environmental literacy, and to determine procedures for meeting those needs within the framework of an environmental science course which will complement an environmental social studies course.

The study was conducted within terms of reference from two sources: (1) the general terms of reference for Primary Education as given in the Lewis/Taylor Report, and (2) the specific directives for the working parties in Environmental Science/Social Studies as provided by the Environmental Education Committee.

General Terms of Reference for Primary Education

The Lewis/Taylor Commission accepted that there are four main stages in the growth of a state educational system (although these stages are not sharply differentiated). These four stages were described by Beeby (1966).

At the first stage, education is provided by private agencies and individuals. There is little involvement of government. At the second stage, there is a great increase in demand for education and the acceptance by the state of its role as the main source of finance. There is need for great centralization regarding the organization and management of schools, development of syllabuses, textbook selection, and a rigid external system of examinations. There is also a shortage of qualified personnel.
The Lewis/Taylor Commission felt that the African primary system in Rhodesia had reached the point of entering Stage III. This stage is described as follows:

With the growth of the system in the previous stage, new possibilities begin to appear. It becomes possible to recruit teachers who have completed a higher level of education. The inadequacies of a system which makes no provision for individual differences become apparent, and syllabuses can be structured more in the light of local needs although they are still centrally approved and controlled. Because of the rise in the level of educational background of the teacher, it becomes possible to introduce more sophisticated approaches to the work: principles of education are studied, attention is given to child growth and development, to learning problems and to linking these to pedagogical methodology. With such teachers it becomes possible to relax, somewhat, the external examining controls, so that some teacher-assessment becomes permissible; there emerge opportunities for limited innovation, but still under external supervision. By and large, subject divisions still remain although their divisions become blurred, so that terms such as "correlation", "integration" and "relevance" begin to be heard. Reliance on a single approved method is superseded by the provision of source material which permits the teacher some choice in both what should be taught and how it should be taught. In all this, however, the teacher is still very much under the direction of the inspectorate whose role is modified and takes on something of the character of an advisory service. The growing recognition of individual differences, and the increasing public awareness of the need for the educational facilities for handicapped children and of remedial work for backward children, results in the establishment of some provision for such children at least on a rudimentary basis (Rhodesia, 1974, p. 4).

Directives of the Environmental Education Committee to the Environmental Science Working Party

The following directives were given by the Environmental Education Committee to the Environmental Science Working Party:

1. To produce a course which shall fire the teachers and pupils with enthusiasm to gain an understanding of the physical and social environment. Through the course the child must appreciate his dependence upon the environment,
identify those elements that contribute to its well-being and begin to accept responsibility for their conservation and improvement.

The course should not only ensure the pupils' keen interest during their years at school but should also provoke their urgent commitment in ensuing years to participating in the solution of environmental and social problems.

2. To develop a course of study for Grades 1-7 with regard to the specification of aims, scope, approach, major concepts to be studied and skills and attitudes to be acquired.

3. To determine the appropriate degree of flexibility in relation to educational and physical feasibility.

4. To collaborate with the other working party to determine areas of integration.

5. To prepare and evaluate materials which will encourage and support teachers in achieving the aims of the course.

6. To report progress, problems and needs to the steering committee at regular intervals (Gilbert, 1978, n.p.).

Objectives of the Study

The ultimate goal of this study was to produce a curriculum for Environmental Science. Although the word "curriculum" has different definitions, the one conceived by Saylor and Alexander was accepted. The curriculum is seen as "a plan for the provision of learning opportunities for a particular set of objectives and a particular population" (Saylor and Alexander, 1974, p. 24).

It was envisaged that a series of procedures or steps would be involved in order to arrive at the desired curriculum. Investigation was conducted into different approaches to curriculum development, and the "systems approach" advocated by Gagne and Briggs (1974) was ultimately selected as being a suitable one for this venture. Its
appeal lies in the fact that this approach is based on one hand in logical, systematic thinking and planning, using theory and available research evidence, and on the other hand depends on the use of facts from evaluation studies for verification of its efficacy. Apart from being an improvement on earlier methods of instructional design, this approach was considered as being most feasible in the Rhodesian situation where the whole task was at hand, from needs assessment to implementation. Also, as this study originated as a joint venture by the Ministry of Education and the University of Rhodesia, and was to ultimately involve schools, teacher-training colleges, and government and community agencies, it was imperative to adopt an organized way (system), meaningful to all concerned, to accomplish the desired goal.

The following steps in Instructional System development, recommended by Gagne and Briggs (1974) were adopted as the objectives of this study:

1. Analysis and identification of needs toward environmental science literacy.
2. Definition of goals and objectives for the course.
3. Identification of alternative ways to meet needs.
4. Design of system components.
5. Analysis of: (a) resources available, (b) resources required, (c) constraints.
6. Selection, or at least decisions about instructional materials.
7. Design of student assessment procedures.
8. Initial field testing.
In general, achievement of these objectives took place in the order shown. However, there was much recycling. Decisions in the early stages affected later-stage ones, and insights gained at later stages led to revision of earlier plans. In addition, data gathering techniques often provided information for more than one stage at a time.

Assumptions

This study was undertaken at a time when the country was at war, and forces were at work to bring about many changes in such areas as health, housing, and education. The following assumptions were made:

1. That Environmental Science for African Primary pupils will continue as an educational priority.
2. That there will be continued cooperation between the Ministry of Education and the University of Rhodesia.
3. That the needs identified by teachers and specialists represent the true needs of pupils.
4. That whereas this venture was conducted under the aegis of the African Division of the Ministry of Education, the curriculum designed will ultimately be used in an integrated primary school system.

Limitations

1. A main limitation of this study was that the results apply primarily to African primary school pupils, and that the curriculum developed may not be applicable for schools outside Rhodesia.
2. Due to the security situation, much of research carried out directly by the Environmental Science Working Party in the classrooms had to be confined to urban and rural schools fairly close to a city. The remote rural schools were only accessible through the supervisors, headmasters, and teachers in these areas.

**Validity**

To determine the validity of this study, the following criteria were set to be achieved:

1. The curriculum plan developed will comply with the requirements of the Rhodesian Ministry of Education.

2. The introduction of an environmental studies course into the schools' curriculum will be acceptable and seen by teachers, pupils, and administrators as being relevant and desirable.

3. The course, as developed, will be appropriate to teacher competencies and available facilities.

**Definitions**

1. **Biophysical environment**: Designates both the natural and man-made components of the environment.

2. **Community**: All the people who live in a particular area, district, city, etc.

3. **Conservation**: The rational use of the environment to improve the quality of living for mankind.

4. **Culture**: Incorporates organizational strategies, technological processes, and social arrangements (political, legal,
managerial, educational, etc.) through which man interacts with the biophysical environment.

5. **Curriculum**: "A plan for the provision of learning opportunities for a particular set of objectives and a particular population" (Saylor and Alexander, 1974, p. 24).

6. **Ecology**: The study of the interrelationships between organisms and with the physical environment.

7. **Education officers**: Refers to employees of the Ministry of Education who work at headquarters with educational planning, curriculum development, and policy.

8. **Environmental protection**: A part of resource management which is concerned with the discharge to the environment of chemical and biological waste and of physical effects (i.e., sound and radioactivity) with the aim of providing a defense against interference, damage, or destruction, in relation to those beneficial uses of natural resources valued by the community.

9. **Environmental science**: The study of the environment using the methodology and philosophy of science.

10. **Habitat**: A physical portion of the environment that is inhabited by an organism or population. It is characterized by a relative uniformity of the physical environment and fairly close interaction of all the biological species involved.

11. **Instructional system**: A plan or structure containing a collection of interrelated components designed to achieve a specific set of instructional objectives.
12. **Pollution**: Any direct or indirect alteration of the physical, thermal, biological, or radioactive properties of any part of the environment by discharging, emitting, or depositing wastes or substances so as to affect any beneficial use adversely.

13. **Preservation**: Keeping in existence unchanged, natural resources, structures, or situations which have been inherited from the past.

14. **Supervisors**: Refers to employees of the Ministry of Education, African Division, who are the liaison persons between the ministry and the schools. Working under the education officers, each supervisor is in charge of supervising the schools within a specified region. Supervisors presently assess teachers, and conduct in-service training.

15. **Team**: Refers to the three members of the Environmental Science Working Party.

16. **Townships**: Reserved areas within, or on the outskirts of cities, where the majority of urban Africans live. They have separate administrations from those of the cities.

17. **Veld**: A grassy rural region with few bushes or trees.
CHAPTER 2

REVIEW OF RELATED LITERATURE

A review of the literature related to this study was conducted primarily into two areas: (1) Environmental Education, and (2) Curriculum and Instructional System Design.

Environmental Education

A review of the literature on this field revealed some recurrent points:

1. There appears to be a consensus of opinion that environmental education is not only desirable, but imperative.

Whereas many innovations in education are controversial, there is no indication in the literature of anything but a general feeling of approval from the general public to politicians, scientists, and educators.

It has become apparent that the processes of rampant technology, land development, irrational consumerism, and indifferences toward destruction of nature have been going on unchecked. In short, there is an environmental crisis. The hope of remediating it now lies in the education of youth toward better management of the environment (Troost and Altman, 1972).

President Nixon emphasized the role of environmental education on several occasions; in his introduction to the annual report of the Council on Environmental Quality, August 1970, he stated:
The basic causes of our environmental troubles are deeply embedded. . . . It should be obvious that we cannot correct deep-rooted causes overnight. . . . We must seek nothing less than a basic reform in the way society looks at problems and makes decisions. Our educational system has a key role to play in bringing about this reform. It is also vital that our entire society develop a new understanding and a new awareness of man's relation to his environment—what might be called "environmental literacy". This will require the development and teaching of environmental concepts at every point in the educational process (Roth, 1976, p. 98).

Mead (1970) believed that there is a realization of the interconnection of the world's peoples, of the vulnerability that this renders us to the effects of actions that may occur even half a world away, such as the dumping of nuclear waste into the seas or polluting the air. There is the realization that not war, but a plethora of man-made wastes is our greatest threat to survival. Mead saw a need to chart new directions for future environmental education models.

The University of Wisconsin—Green Bay focused all its activities, subject matter, and professional education on man and his environment. Its Chancellor, Dr. Weidner believed that man can no longer have true peace, or true love without a substantial measure of environmental quality. He maintained that education is essential to saving our environment, and an environmental focus makes for effective education (Weidner, 1971).

When man first stepped on the moon on the twenty-first of July, 1969, an interesting trend began. The space program started decelerating and the ecology program accelerated. This is because when man stepped on the moon, he turned around and looked back; he saw for the first time earth as a living entity! The event was witnessed by millions of people, and the Age of Ecology was born (Lowe, 1971).
With the dawning of ecological awareness, the conviction that man must re-learn to come to terms with nature, has emerged (Gorden and Gorden, 1972).

There is an increasing opinion that science and technology are not going to save us from our environmental crisis. Joseph Wood Krutch once remarked: "What we need are men not more clever but more wise" (Lowe, 1971, p. 18). The hope is that environmental education will produce new and enlightened generalists who will save the human race from extinction (Levine, LeMaistre, and LeMaistre, 1972).

In Rhodesia, environmental teaching studies in primary schools has been seen to be a "response to a new urgency in national concern about deteriorating land resources and other problems" (Robson, 1977, p. 195).

2. Historically there have been numerous attempts to make education about various aspects of the environment meaningful and relevant but not until recently has the interpretation of environmental education gained focus.

The Nature study movement of the early 1900's (National Society for the Study of Education, 1940) did much to move the classroom "outdoors" and to promote the idea of nature conservation, the preservation of natural plant, and sometimes animal, communities as representative examples of their kind. It was an attempt to make nature "relevant" to the students, but it was primarily agriculture oriented.

Leopold (1949), a forester and hunter, wrote the classic work, *A Sand County Almanac*, in which he proposed that a land ethic that
regards a thing as good when it contributes to the biotic community and as bad when otherwise, is needed to be developed and taught.

The launching of Sputnik I and II in 1957 and 1958 led parents, educators, and scientists in the United States to be concerned about the nature of the science curriculum, especially at the secondary level. New programs were developed by the National Science Foundation. Due to criticism, these have been revised. Committees appointed by principals and superintendents have tailored these for use at the local level with major emphasis on environmental problems. The major drawbacks of these programs then were that originally they did not take local needs enough into consideration, and that they were basically science oriented (Qutub, 1973).

The development of ecological awareness in the 60's spurred the teaching of the interactions among living things and of the interrelationship between living things and their environment. These ecology courses have been heavily biology oriented.

In 1968, the U. S. Department of Health, Education, and Welfare established an office of environmental education and the Conservation Foundation embarked upon a three year, half-million dollar national promotional program (Swan, 1969).

As signs of our mismanagement of the environment such as erosion due to strip mines, or oil spillages in coastal waters, became apparent, the public became concerned with the environment. Community-wide programs were organized, and demands for courses on environmental science were made. These activities culminated in Earth Day April 22, 1970 (Steidle, 1977).
In England, Robert Arvill, in 1967, advocated a form of environmental education requiring a new approach in schools. He felt the aim of environmental education should be "the stimulation of enquiry into the factors governing environment and the interactions between it and man." He considered that "man's powers and responsibilities, and his capacity to alter and recreate society should be explained to pupils" (Martin, 1975, p. 20).

In Switzerland, the first European Conference on Environmental Conservation Education was attended by scientists, administrators, and educators from 21 nations. It was organized by the International Union for Conservation of Nature and Natural Resources (IUCN) in cooperation with the World Wildlife Fund (WWF) and with the support of the Swiss Government. The Conference formulated specific recommendations for projects and programs in environmental education related to primary and secondary levels, teacher training, higher education, and out-of-school education (Cerovsky, 1971b). Still the emphasis appeared to be on the better appreciation and management of the biophysical environment.

In the United States, largely in response to the public's demands, the ninety-first Congress made an effort toward regulating environmental quality through the enactment of several pieces of legislation, the major one being the Environmental Education Act, which required six months of work to be developed and passed, and was enacted on October 30, 1970.

The Environmental Education Act was considered of great importance because it was not only concerned with cleaning up the
environmental mess, but it added new dimensions to the concept of environmental education. Environmental education was seen as the educational process dealing with man's relationship with his natural and man-made surroundings, and included the relation of population, pollution, resource allocation and depletion, conservation, transportation, technology, and urban and rural planning to the total human environment (Steidle, 1977).

The Act was also important because it provided for making grants to and contracts with state departments of education, local school districts, organizations, and institutions to support research and pilot projects designed to produce environmental literacy.

In Stockholm, in 1972, the United Nations sponsored a Conference on the Human Environment, which was attended by 113 delegations from all over the world. The purpose was to consider the need for a common outlook and for common principles to inspire and guide the peoples of the world in the preservation and enhancement of the human environment (Gilpin, 1976). This conference did much to focus on the need for environmental education on a global and comprehensive basis. Withrington (1977, p. 34) stated that one potentially positive outcome of this conference has been the establishment of a United Nations programme in environmental education according to the recommendation of the United Nations General Assembly that "the organisations of the United Nations system, specially UNESCO, and the other international agencies concerned, should, after consultation and agreement, take the necessary steps to establish an international programme in environmental education, interdisciplinary in approach, in-school and out-of-school, encompassing all levels of education and directed towards the general public, in particular the ordinary citizen living in rural and urban areas, youth and
adult alike, with a view to educating him as to the simple steps he might take, within his means, to manage and control his environment."

By January, 1975, a plan designed by UNESCO was accepted for three years funding (four million dollars) by the United Nations Environment Program (UNEP).

In Africa, the major curriculum changes in primary school science in the sixties, such as the African Primary Science Program (APSP), were oriented toward a better understanding of the environment. In Rhodesia it was not until 1974 that a Commission of Inquiry recommended the introduction of environmental studies as such into the curriculum (Rhodesia, 1974).

As the field of environmental education has developed, so has a greater consensus as to how to define it been achieved. A current idea is to interpret environmental education as "the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among man, his culture, and his biophysical surroundings" (Cerovsky, 1971a, p. 17).

3. There are major problems in the implementation of environmental education.

Because of its nature, environmental education can take many forms. Curriculum guides are being developed from individual schools, school districts to state and national levels. The exact form of environmental programs will depend on many variables. These include such factors as the guidelines that have to be followed, the structure
of the curriculum, administrative competence and interest, the commitment of the teachers, student values, interest and abilities, facilities and equipment, and the type of community which the school serves (Troost and Altman, 1972).

Because environmental education incorporates a new structure—a synthesis of the hard sciences, social sciences, and the humanities, there is no clear cut way of incorporating it into the curriculum. Some writers firmly believe that you cannot build it into the curriculum as one more subject to be added on (Stapp, 1971). For one thing, the secondary school curriculum is already crowded. At the secondary level there is the possibility of the integration of ecology topics into regular courses like English, social studies, or biology; or the development of new interdisciplinary courses or the adoption of total prefabricated courses which have been developed by professional groups (Troost and Altman, 1972). In Africa, it is particularly important to introduce environmental studies at the primary level as only a relatively small percentage of pupils go on to secondary education now.

Environmental education cannot avoid value questions, and the public schools have tried to steer clear out of value discussion, especially those that run counter to established norms. Since so many of our commonly held social values are not compatible with resolving environmental problems, i.e., pollution, dissonance and stress are bound to occur. Swan (1971) suggested that in-depth analysis of our environmental problems and a meaningful move to solve them is necessary. This will call for major changes in our economic, political, and social systems. He suggested dropping currently existing "isms" used to label
our various political and economic systems—such as capitalism, socialism, communism—and strive toward a new system called "environmentalism" which will apply to any society which is designed to provide its inhabitants with the highest possible quality of life. Stapp (1971) suggested the need to develop attitudes and skills that result in a changing lifestyle which, in turn, directs corporate, governmental, and consumer attention toward alleviating the various manifestations of environmental decay. In Rhodesia, an extra dimension is added to the question of values, when problems of national concern such as overpopulation and soil erosion due to over-grazing are aggravated by widely held traditional beliefs and practices.

The field of environmental education is still relatively new and there is a shortage of well qualified personnel. There is a dire need to train teachers in this field. Although increasingly, universities are incorporating some forms of environmental education in their teacher-training programs, most systems have to depend on in-service training for environmental education teachers. There is a need for government to help support teacher-training programs in environmental education (Stapp, 1971).

There are efforts being made to determine what are the required competencies that teachers should have. For example, Buterbaugh (1970) conducted a survey which entailed a mailed questionnaire to one hundred recognized leaders in environmental education for determining the knowledge and skill concepts deemed necessary for outdoor/environmental teachers at both elementary and secondary levels. Sixty-seven responded, and indicated that under-graduate programs
should provide one or two environmental education courses; an adequate understanding of the biological sciences; an interdisciplinary approach to courses in biology, geology, history, political science, and natural resources; and greater emphasis upon elementary teacher preparation curricula. Other recommendations were made at the graduate level.

The implementation of the environment-oriented APSP in Ghana, Sierra Leone, Tanzania, Uganda, and Kenya depended very heavily on a very comprehensive program for in-service and pre-service courses for teachers (Education Development Center, 1976).

There is a need to develop new teaching materials. The literature points consistently to this problem and provides means of alleviating it. A needs assessment in this area was undertaken by Ingison and Peter (1976), of the Research and Development Center for Cognitive Learning of the University of Wisconsin. Results indicated that current materials were widely used but were not adequate for several grade levels. There was also a great need for supplementary materials.

One of the major thrusts of the African Primary Science Program was the development of materials, and these had to be modified and adapted for use by the participating countries (Education Development Center, 1976). In African countries, with such widely varying physical and social environmental conditions, the need for developing new materials for new programs introducing new approaches seems imperative (Robins, 1970).

In respect to Africa, and specifically Rhodesia, environmental education per se is just getting underway. This points to the need for
conducting preliminary research in the field. Curle (1973) dealt with some fundamental political, social, and psychological issues which perhaps should be considered in the development of environmental education programs.

4. The literature provides a wealth of resources for the development of environmental education courses and teaching materials.

Initially, the literature may serve as a source of concepts to be taught. Roth (1971) attempted to develop a taxonomy of conceptual objectives for use in planning programs of instruction related to environmental management education from kindergarten through university. Survey techniques to obtain and validate concepts appropriate to this field involved questionnaires and personal interviews. The population consisted of scholars in disciplines related to environmental management who were with the University of Wisconsin and other selected American universities. A list of 128 concepts, developed with the cooperation of a Wisconsin panel of scholars, was submitted to the national panel consisting of 699 scholars representing 40 academic disciplines in 24 universities from 12 ecological zones in the United States.

Responses from 50.07% of the scholars showed acceptance of 111 concepts by 90% of the respondents. These concepts were then organized into a taxonomic list according to topic on the basis of weighted item mean score. Thirteen topics served in classifying the concepts: environmental management, economics, management techniques, environmental problems, adaptation and evolution, environmental
ecology, natural resources, the sociocultural environment, culture, politics, the family, the individual, and psychological aspects. This classification is not exhaustive but is suggested as one possible organization of topics and concepts.

The writer is of the opinion that the validity of this study indicates that knowledge of these concepts on this taxonomic list can be considered as a basis for understanding environmental management, and appropriate for use in public schools throughout the United States. It can also be used as a starting point for developing similar taxonomic lists in other countries.

The literature provides materials for the redirection of currently existing courses toward environmental education. For an approach to environmental education via enrichment of existing subject matter rather than through the development of a new course, there are many books in the various subjects (English, social studies, biology, chemistry, etc.) with an environmental approach. For example, Priest (1973) approached a study of physics through the problems of energy, transportation, and pollution. Fuller (1974) and Wade (1976) made environmental chemistry the basis of books which could be used in a chemistry class. Lenniham and Fletcher (1976) have studied health from an environmental viewpoint. There are many other books and materials like these which could be used in existing school programs to give them a redirection toward environmental education.

The literature serves as a source of reference for teaching methodology. It provides some novel ideas for teaching environmental education. Van Deman (1977) demonstrated a way to teach about the
environment through sensory awareness. Leyh (1977) suggested "look-see" experiences. McCollum (1977) recommended research projects. Wert (1974) suggested field trips to environmental study areas, and the organization of pre-trip, trip, and post-trip activities for the students. McDonald and McDonald (1971) described how people in resource agencies and community organizations can assist educators, while Qutub (1973) discussed different learning techniques which may be used.

The literature may be a source for curriculum materials and packages. The Forest Service of the U. S. Department of Agriculture has been instrumental in producing material such as a set of lesson plans for elementary school use.

The various state departments of education have also produced materials. For instance, the Arizona Department of Education developed an elementary teachers resource guide for environmental education for grades K-8 in 1973. By 1976, it had printed and distributed 4000 copies to elementary schools and teachers in Arizona. This department has recently produced an expanded guide which includes activities for grades K-12 (Arizona Department of Education, 1977).

A Teacher's Guide to the African Primary Science Programs provides descriptions of the purpose, materials required, and activities of 51 teaching units at various levels. A booklet for each unit has been developed (African Primary Science Program, 1971). The Three Phase Primary Science (TPPS) project assisted by UNICEF/UNESCO, and focusing on science teaching at primary and secondary levels, was environment-oriented (Williams, 1977). This program yielded a novel
presentation of lessons. A useful annotated bibliography of selected materials and services available for environmental education is provided by Cummings and Byars (1975).

In addition, journals such as the *Journal of Environmental Education*, *Environment*, and the *Journal of Environmental Quality* may be used as sources of materials and suggestions. Stapp and Liston (1975) have produced an annotated compilation of sources of materials, information and support, educational, consultative, and financial, for environmental efforts at all educational levels.

**Curriculum and Instructional System Design**

For the purposes of determining procedures for effectively designing an environmental education course, investigation into various aspects of curriculum and instructional system design was conducted. There is really no clear separation between the two. Whereas some writers regard curriculum primarily in terms of its domain (content), there are others who regard curriculum as a system which includes goals, domains, instruction, and evaluation (Saylor and Alexander, 1974).

During the 60's there tended to be a separation, in theory, between curriculum and instruction. An example is provided by the model developed by Macdonald (1965) who regarded curriculum, instruction, teaching, and learning as four related, overlapping systems.

Beauchamp (1968, p. 108) wrote about curriculum "engineering" as consisting of "all the processes necessary to make a curriculum
system functional in schools." He used the term to include both the decision-making and its implementation.

In the opinion of the writer, Joyce (1971, p. 312) accurately assessed the state of the curriculum field in the 1971 Yearbook of the National Society for the Study of Education:

The curriculum field is still relatively undefined. Curriculum planners have no agreed upon set of concepts or modes which are known and used by all hands. There is no lack of "prescriptive" curriculum theories—that is to say, ideas about what school programs ought to be . . . .

Increasingly, however, a systems approach to educational design is being advocated. Kaufman (1976) provided a good model for a systematic approach to educational design. A "systems approach" to curriculum planning would entail an analysis of plans and planning organizations in "terms of the relations of ends and means, the attention to pertinent factors and data, and the flow of activities from beginning to end" (Saylor and Alexander, 1974, p. 26). Curriculum textbooks such as Saylor and Alexander (1974) and McNeil (1977) are good sources of techniques for systematically designing, evaluating, and changing curricula and instructional systems.

Gagne and Briggs (1974) provided a comprehensive source of reference on instructional design. The basis for their recommendations lie in the foundations of learning theory and principles. Guidelines were offered on procedures ranging from determining course content all the way down to planning an individual lesson, and including evaluative procedures.

McNeil (1977) pointed to the importance of needs assessment in determining curriculum ends (or course content, for that matter) and
Kaufman (1975) and Ingison and Peter (1976) provided examples of needs assessment studies and procedures.

Whereas the nature of the objectives of a course will largely be determined on the outcomes of a needs assessment, other valuable considerations on determining objectives were provided by Mager (1962) and Bloom (1956).

Scriven (1967), Provus (1971), Parlett and Hamilton (1972), and Stake (1976) developed models for evaluating educational programs. Popham (1972); Gottman and Clasen (1972); and Bloom, Hastings, and Madaus (1971) gave practical guidelines for the evaluator.

Curle (1973) and Mukherjee (1967) provided insights into unique conditions in other countries which are factors which must be considered in curriculum planning there. Chesswas (1969), a practitioner of educational planning in a developing African country for many years, provided a good source of quantitative methodologies used in modern educational planning.

Of value to this study were the experiences gained and data gathered through curriculum development projects in English-speaking African countries. The Massachusetts Education Development Center compiled considerable literature on the development and implementation phases of the African Primary Science Program. The evaluation studies of Duckworth (1971) and Johnson (1970) provided evidence to encourage more activity-based, child-centered approaches. Yoloye's (1971, 1975a, 1975b) studies helped pave the way for more realistic assessment of materials for both pupils and teachers. Hawes's (1977) review of various curriculum development programs in such countries as Botswana,
Malawi, Tanzania, Kenya, and Swaziland, pointed out common pitfalls to avoid.

Most pertinent to this project, of course, were the results of relevant research studies conducted in Rhodesia. Leach (1977a, 1977b, 1977c, 1978) carried out research in the area of pictorial interpretation by primary school Shona children. His results pointed to the need for training for better pictorial interpretation. Hendricks (1966) conducted an investigation of the number concepts and level of number development in preschool Shona children which shows that nursery school experience can have a very positive effect in this area of development. Orbell (1970) studied abstract reasoning among seventh graders. Kileff (1973) provided some useful insights into the effects of education and socialization on rural primary school children. Parker (1976) ventured into primary school conservation education, and provided evidence that it can be achieved successfully. Finally, Robson's (1977) Primary Science curriculum development project allowed assessment of the acceptability of a process-focused science curriculum in Rhodesian primary schools. In addition, Robson (1974) provided useful research information about the use of radio lessons to supplement school lessons.

All in all, the review of literature was an invaluable aid throughout this study. Initially, it provided a firm base from which to launch a new curriculum program, and as the work progressed, it was a source of guidelines and answers to emerging issues and problems.
CHAPTER 3
PROCEDURES FOR THE STUDY

An important consideration in selecting the procedures to be used in this study was that the distinction between research and development and operational programming in the area of curriculum development is not always clear. Pure research carried out in a detached "pre-commitment" atmosphere was not seen appropriate or welcomed in this case. A developing or a transitional country such as Rhodesia, concerned about improving the quality of its education, is more interested in effecting change than in spending resources in researching problems. However, it is possible to research questions of concern while a program of change is operating, thus serving both interests (Robins, 1970). So it was with this mind, that some of the steps in the development of this curriculum were more change oriented, while others were more research oriented.

First, a literature search was conducted into two main areas: (1) Environmental Education--general and Africa in particular and (2) Curriculum and Instructional System Design--general, Africa, and Rhodesia in particular.

Next, the objectives of the study were defined and procedures for meeting them, determined. They were as follows:

1. Objective No. 1--Identification of needs for environmental literacy. The following approaches were used:
a. Questionnaires and Interviews:

(1) Using a modified Delphi technique, teachers and educationists in the field were asked what they considered necessary to include in an Environmental Studies course and why. A second questionnaire asked them to rank the ideas produced in order of priority.

(2) The results of a questionnaire to members of the Conservation and Awareness Workshop (an organization of people active in the field of Conservation Education) provided input of needs as expressed by conservationists and other community agencies vitally interested in Environmental Education.

(3) Interviews were held with education officers, headmasters, supervisors, and members of the community.

b. Classroom experience across a broad spectrum of schools:

(1) For one month, observation was carried out in classrooms from Grades 1-7 in 10 schools. Using a checklist (Appendix F), information was obtained regarding teaching materials, techniques, grouping, resources, time allocation, and use of Shona in the classroom.

(2) For six months, the Environmental Science Working Party (the team) taught in classrooms at all grade levels (1 to 7) in different rural and urban schools. Sometimes, the team would divide the class in three and each member of the team would teach a third of the pupils the same subject matter using the same approaches.
At other times, different team members taught different subjects at different levels. Sometimes, the same subject and approach was used at different levels. Each teaching session was followed by a discussion with the teacher and then by a discussion among the team members. The object was to get a really good appreciation and feel of the needs across a single classroom, across the school, and across different types of schools.

c. Review of currently existing geography, gardening, and science programs and any evaluations carried out on these.

2. Objective No. 2—Definition of objectives for the course. The following were studied and utilized:

a. The objectives recommended for primary education in general in the Lewis/Taylor Report (Rhodesia, 1974).

b. The broad objectives recommended in the Lewis/Taylor Report for Environmental Studies: Physical (Environmental Science).

c. Objectives for Environmental Science as interpreted by the Environmental Education Committee.

d. An analysis of the results from the questionnaires to teachers and educationists.

e. Objectives for Environmental Education as suggested by the literature in general.

3. Objective No. 3—Identification of alternative ways to meet needs. The following step was taken:
a. An informal survey of the activities and materials produced by agencies and organizations concerned with environmental issues was conducted to determine whether some of the pupils' needs were being met or may be met outside the school. These included the National Resources Board, Department of National Parks and Wildlife Management, Department of Conservation and Extension, Young Farmers' Clubs, Tribal Trust Land Development Corporation, Forestry Commission, and the Department of Community Development.

4. Objective No. 4—Design of System Components. The sum total of all the procedures used in this study were utilized, since this involved making decisions regarding:

a. Nature of the materials for study.

b. Methods of studying materials.

c. Self-pacing versus group-pacing of materials for presentation.

d. The nature of the activities of the learner.

e. How to keep track of pupil progress, and how to direct pupil progress.

f. The role of the teacher.

g. The time limits, or whether mastery, rather than time is the scheduling constraint.

h. Assessment of pupil performance.

Procedures used then were interviews and questionnaires for teachers and educationists, classroom observation and teaching experience, trial lessons on a wide range of topics,
particularly those that presented conceptual problems, and study of relevant research and materials.

5. Objective No. 5—Analysis of resources available, resources required, and constraints. The following steps were taken:

a. A picture of the physical and human resources available was obtained by means of:

(1) First hand observations gained from visits to the range of schools existing in Rhodesia today, i.e., government schools, aided schools, farm schools, private schools.


(3) Interviews of education officers, supervisors, headmasters, and teachers and pupils.

(4) An investigation of possible study areas and materials available through organizations and government departments concerned with environmental issues.

b. A determination of resources required had to be largely made on the basis of that was already available and on what was a reasonable likelihood of obtaining increased resources. The procedure adopted initially, during the development of the lesson units, was to make the selection of the resources required (i.e., materials, activities, and media) on an individual lesson basis. The question asked was "How best can one bring about effective learning conditions for each lesson?" The criteria for choosing the resources included cost, availability, ease of use, estimated effectiveness
for the purpose, practicality for storage, familiarity with the media, and, of course, acceptability to the teacher and pupils. The validity of these choices was then determined by means of classroom trials by the team and then by means of field trials.

c. Each of the components of the lessons, as they were developed, were reviewed in terms of available resources and constraints. Examples of constraints were such things as conflicts between planned activities and time scheduled in a fixed time-table, or conflicts between planned grouping and space available. If efforts to remove the constraints failed, then the procedure was to modify the lesson.

6. Objective No. 6—Decisions about instructional materials.

Procedures used to meet this objective were:

a. Study of the instructional materials currently being used in primary science and geography courses and of any formal evaluation of them to determine which are their strong points and which are their weak ones.

b. Study of instructional materials being used in other primary science and environmental study programs in various countries.

c. Consultation with Ministry of Education officials to determine what policy is in effect concerning pupil textbooks, teachers' guides, and other instructional materials.
d. Consultation with teacher trainers, education officers, supervisors, and headmasters.

e. Classroom trials by team of materials and field trials of selected teacher's guide format.

7. Objective No. 7—Design of pupil assessment procedures. The procedures followed to achieve this objective were as follows:

a. Looking at the effectiveness of assessment procedures currently in practice.

b. Study of assessment procedures as recommended by the literature.

c. Trials of different assessment methods to determine their usefulness.

8. Objective No. 8—Field testing. The approach to field testing was as follows:

a. After a set of lessons for a unit was developed, the material was tried out on team members for initial reactions.

b. After initial revision, the lessons were taught by each of the three team members to small groups of pupils within the same class with class teacher observing. This was followed by discussions with the class teacher and then by discussion among the team members.

c. After more modification, the lessons were prepared for wider field testing. They were mimeographed and accompanied by an evaluation exercise and a questionnaire to be completed by each teacher who was to teach the unit. Then each set
was mailed out to at least 15 schools selected at random in different parts of the country.

Figure 1 diagrammatically shows the work of the three members of the Environmental Science Working Party (team), and the procedures adopted to achieve the objectives of the project.
I. Establishment of Team

Incorporation of manpower to handle
-- background research (1)
-- innovation (2)
-- African feelings & aspirations (3)

II. Review of literature (1)

Current developments in Environmental Education

Questionnaires to teachers (1)

Contact African teachers
Establish rapport, create climate for change (3)

Define priorities for syllabus--based on own (2)
experience & feedback from others

Report on resources, constraints (1)

III. Development of lessons: team teaching & individual teaching

IV. Team:
Selects main topic themes

Breaks down topic themes for progressive development from grades 1-7

Integrates content to ensure logical development of topics

Suggests classroom & outside activities to accompany stages in topic development

Defines underlying concepts, attitudes & skills at each stage

Rewriting: Pilot lesson units

Feedback: modification

Figure 1. Work of the Environmental Science Working Party and Procedures Adopted in
II. Team defines its brief:
- Environmental Studies Education Committee
- Lewis/Taylor Report

Team consults:
- personnel involved in schools
- personnel administering policy from outside school
- teacher trainers

Team observes + involves schools in operation, classroom teaching

Team looks at existing curriculum:
- science, geography, math

Team considers national needs: consults outside agencies

Clarification of lesson objectives, identification of concepts, skills attitudes
Devising pupil assessment exercises. Identifying resources available, needs.

Discussion, consideration of educational format. Arriving at consensus of approach. Devising format for teacher's evaluation

Trials by teachers in schools

Format for instructional material decision 1979

CHAPTER 4

RESULTS OF THE STUDY

This chapter includes the results of the investigations and procedures carried out in order to achieve the objectives of the study. The results are presented under the following sections:

1. Needs Assessment
2. Definition of Aims and Objectives for the Course
3. Analysis of Alternate Ways to Meet Needs
4. System Components
5. Analysis of Resources Available, Resources Required, and Constraints
6. Instructional Materials
7. Pupil Assessment
8. Initial Field Trials of Lesson Units

Needs Assessment

One of the main objectives of this study was to identify the needs for environmental literacy. To do this, data were obtained from a variety of sources.

Environmental Education Needs Expressed by the Profession

Two questionnaires were the main instruments used to obtain input from the profession.
Questionnaire I. Since the purpose and scope of the Environmental Science course was to be based on the needs of primary school pupils toward achieving environmental literacy it was seen imperative to determine what teachers, headmasters, and supervisors perceived to be important to include in the course and why. To this end, Questionnaire I, a simple open-ended questionnaire, was designed (Appendix A). It was decided not to define "Environmental Studies" or "Environmental Science" at this time so as not to limit, or inhibit or prejudice opinions. It was also decided to ask for ideas for Environmental Studies generally and then pass ideas which would be more appropriate for Environmental Social Studies to the Working Party concerned with this aspect.

The purpose of the questionnaire was to obtain suggested topics or main ideas, with supporting reasons, for an Environmental Studies course from teachers and some headmasters, supervisors, and education officers.

The questionnaire was examined by members of the team and by members of the Environmental Social Studies Working Party and agreed to have face validity.

A stratified type sample was seen appropriate in this case. Through each of the seven Provincial Education Officers, questionnaires were distributed to be completed by the following:

1. One education officer particularly concerned with Environmental Studies.

2. One supervisor particularly concerned with Environmental Studies.
3. One headmaster particularly interested in Environmental Studies.

4. One teacher from each grade in a centrally located rural (C.P.S.) type school.

5. One teacher from each grade in a remote rural type school.

6. One teacher from each grade in an urban type school.

This provided 24 questionnaires for each province, or a total of 168 for the seven provinces. Figure 2 shows the 7 Provincial Subdivisions of the Ministry of Education, African Division.

One hundred fifty-eight questionnaires were completed and returned. Also received were 98 additional returns from two provinces (Matabeleland North and Manicaland) making a total of 256 returns. The respondents in these two provinces demonstrated their great interest by mimeographing some more of the questionnaires and distributing them to more of their teachers. Most questionnaires contained more than one suggested topic. There were a total of 511 suggestions given, and a total of 95 different topics were suggested as being important to include in an Environmental Studies Course. In Table 1 are those most frequently suggested.

The reasons given by the respondents as to why they would like their suggested topic(s) included varied greatly, but on closer examination, certain recurrent ideas appeared prevalent. The various reasons offered fell mainly around several expressed desires. These then were selected as the following categories:

1. The desire for relevance to the pupil's experience and surroundings.
Figure 2. The Provincial Subdivisions of the Ministry of Education, African Division
Table 1. Topics Most Frequently Suggested by Educators for Inclusion in a Primary Environmental Studies Course

<table>
<thead>
<tr>
<th>Topic</th>
<th>No. of Times Suggested</th>
<th>Order of Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>42</td>
<td>1</td>
</tr>
<tr>
<td>Water</td>
<td>33</td>
<td>2</td>
</tr>
<tr>
<td>Conservation of natural resources</td>
<td>32</td>
<td>3</td>
</tr>
<tr>
<td>Nutrition</td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td>Common animals and wildlife</td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td>Grass</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>Traditions and customs</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Pollution</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Local history</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>Sanitation hygiene</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Disease</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Common plants</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Toilets</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Gardening</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>The township or village</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Local physical features</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Farming</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Local industry/trade</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Balance of nature (interdependence)</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Trees</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Animal husbandry</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>National figures and heroes</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Road safety</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Poultry</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Food production</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Dams</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Civics</td>
<td>5</td>
<td>27</td>
</tr>
<tr>
<td>Birds</td>
<td>5</td>
<td>27</td>
</tr>
</tbody>
</table>

2. The desire for knowledge which can directly or indirectly help to improve the quality of the pupil's life (health, social, physical comfort, and safety).

3. The desire for information which can help to grow crops and raise animals for food and for money.

4. A desire for a sense of identity and pride in cultural heritage.

5. A desire to cultivate interest in managing natural resources such as soil and water more wisely (usually as a result of problems perceived in the environment).

Three judges (two lecturers from the Science Education Centre at the University of Rhodesia, and one secondary school teacher) were asked to place thirty given reasons, which were selected at random, into these categories. They did so with an agreement of 88.9% between themselves. The researcher also carried out the exercise and the judges and researcher agreed 88 per cent of the time. On this basis, all the reasons given in the questionnaires were categorized. The results are presented in Table 2.

The figures on Table 2 indicate that the most commonly given reason for including certain topics or ideas in an Environmental Studies curriculum was in the hope that knowledge would be gained which would help improve the quality of the pupils' lives. In a country where the large majority of primary school pupils would not be continuing into secondary schools, and where major social and political changes were taking place, this finding was not surprising. The second most commonly given reason expressed a desire to manage natural resources more wisely.
### Table 2. Categorized Reasons Given by Teachers, Headmasters, and Supervisors for the Inclusion of Recommended Topics

<table>
<thead>
<tr>
<th>Reason Category</th>
<th>Victoria</th>
<th>Midlands</th>
<th>Matabeleland North</th>
<th>Matabeleland South</th>
<th>Mashonaland West/Central</th>
<th>Mashonaland East</th>
<th>Manicaland</th>
<th>Total No. of Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevance to pupils' experiences and surroundings</td>
<td>2</td>
<td>7</td>
<td>17</td>
<td>2</td>
<td>11</td>
<td>8</td>
<td>22</td>
<td>68</td>
</tr>
<tr>
<td>Knowledge which helps to improve quality of life (social, physical, and material)</td>
<td>6</td>
<td>3</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>9</td>
<td>51</td>
<td>101</td>
</tr>
<tr>
<td>Specific information to help grow crops and raise animals for money</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>18</td>
<td>46</td>
</tr>
<tr>
<td>Sense of identity and pride in cultural heritage</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td>Managing natural resources more wisely</td>
<td>10</td>
<td>5</td>
<td>15</td>
<td>2</td>
<td>10</td>
<td>5</td>
<td>39</td>
<td>86</td>
</tr>
<tr>
<td>Subtotals</td>
<td>24</td>
<td>22</td>
<td>53</td>
<td>18</td>
<td>40</td>
<td>30</td>
<td>137</td>
<td>324</td>
</tr>
</tbody>
</table>
This result was surprising and gratifying because, despite generally relatively low educational qualifications, it showed that the teachers, headmasters, and supervisors were knowledgeable about the need for better management of our environment. The third most commonly given reason expressed a desire for relevance to pupils' experiences and surroundings. This finding was later supported in Questionnaire II where the major criticisms of textbooks being used in the classrooms concerned areas which were very remote from pupils' and teachers' experiences.

From the beginning, the Environmental Science Working Party worked in close liaison with the Environmental Studies (Social) Working Party. The latter consisted of three members of the Education Development Unit of the Ministry of Education, whose function was to develop a curriculum plan, concerned with the human and social aspects of environmental studies, which would complement the Environmental Science curriculum. Questionnaire I was a general, open-ended questionnaire intended to provide input for both working parties. In this respect, certain recommended topics seemed more appropriate in the social studies area, and they were referred to the Environmental Studies (Social) Working Party. These are presented in Table 3.

Questionnaire II. After referring those most appropriate for the social aspect of Environmental Studies to the Environmental Studies (Social) Working Party, the forty-nine most frequently mentioned topics or main ideas were listed in a second questionnaire (Appendix B) to be
<table>
<thead>
<tr>
<th>Topic</th>
<th>No. of Times Suggested</th>
<th>Order of Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditions and customs</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Local history</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>The township or village</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>National figures and heroes</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>Road safety</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>Local industry/trade</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Civics</td>
<td>5</td>
<td>26</td>
</tr>
<tr>
<td>Roads</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Scripture</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Manners</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Population</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Sex education</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Tribal courts</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>Economics</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>Mines</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>Education</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>Public places (use of)</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>Careers and jobs</td>
<td>2</td>
<td>49</td>
</tr>
<tr>
<td>Transport</td>
<td>2</td>
<td>49</td>
</tr>
<tr>
<td>Budgeting</td>
<td>2</td>
<td>49</td>
</tr>
<tr>
<td>Crafts</td>
<td>2</td>
<td>49</td>
</tr>
<tr>
<td>Recreation (use of leisure)</td>
<td>2</td>
<td>49</td>
</tr>
<tr>
<td>Social control (authority)</td>
<td>2</td>
<td>49</td>
</tr>
<tr>
<td>Communication</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>Social welfare</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>Building</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>Vehicles</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>Current affairs</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>Neighboring countries</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>Talks by community members</td>
<td>1</td>
<td>64</td>
</tr>
</tbody>
</table>
ranked in order of importance for inclusion into an Environmental Science curriculum.

Questionnaire II was designed to serve three purposes:

1. To survey the range of teacher qualifications and teaching experience.

2. To solicit the respondents' views on what is most worthwhile and least worthwhile about the science and geography books they are now using.

3. To narrow down the list of suggested topics and main ideas into the most important ones.

The questionnaire was examined by members of the team and three lecturers of the Science Education Centre, and appeared to have face validity.

A stratified type sample was used with Questionnaire I, so as to obtain responses from all the Provinces and throughout the education, administration, and teaching grades. A much larger sample was seen appropriate in this case. Through each of the seven Provincial Education Officers in the country, questionnaires were distributed to be completed by the following:

1. Three education officers particularly concerned with Environmental Studies.

2. Three supervisors also interested in this field.

3. Three headmasters also interested in Environmental Studies.
4. Seven teachers, from Grade 1 to Grade 7, from each of nine schools in each Province (3 urban, 3 rural CPS, and 3 remote rural).

This provided 72 questionnaires for each Province, or a total of 504 for the seven Provinces.

A total of 519 returns was received because additional returns were received from 10 headmasters and 5 supervisors who, unasked, sent in completed copies of the questionnaire. The results for Parts I and II of the questionnaire will be presented in following sections. Table 4 presents the results of Part III, the views on the importance of including the suggested topics or main ideas given in the first questionnaire. The figures show the number of responses in each category. A mean importance value was computed for each topic by assigning points for each response as follows: Very Important—4, Important—3, Not Important—2, Do Not Include—1. The topics are listed in decreasing order of their mean importance value.

These results indicated very strong preferences for topics which fell under certain areas. For example, heading the list were Soil and Water, followed closely by Grass and Trees. These topics could be grouped under Natural Resources. There appeared to be a strong interest for educating for Conservation of Natural Resources. There was also a definite preference for Food Production, Gardening, and Agriculture which could be grouped under the general area of Agriculture. Nutrition, Disease, and Hygiene were topics which were shown to be of great importance for inclusion, and these could be included in a general area of Health Education.
Table 4. Summary of Teachers', Headmasters', Supervisors', and Education Officers' Views on the Importance of Including Topics/ Main Ideas Suggested in Questionnaire I

<table>
<thead>
<tr>
<th>Topic</th>
<th>Very Important</th>
<th>Important</th>
<th>Not Important</th>
<th>Do Not Include</th>
<th>Importance Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>407</td>
<td>38</td>
<td>6</td>
<td>7</td>
<td>3.844</td>
</tr>
<tr>
<td>Water</td>
<td>407</td>
<td>88</td>
<td>9</td>
<td>5</td>
<td>3.773</td>
</tr>
<tr>
<td>Disease</td>
<td>383</td>
<td>111</td>
<td>14</td>
<td>6</td>
<td>3.694</td>
</tr>
<tr>
<td>Toilets</td>
<td>377</td>
<td>107</td>
<td>15</td>
<td>8</td>
<td>3.682</td>
</tr>
<tr>
<td>Sanitation/hygiene</td>
<td>350</td>
<td>143</td>
<td>7</td>
<td>6</td>
<td>3.654</td>
</tr>
<tr>
<td>Food production</td>
<td>337</td>
<td>150</td>
<td>24</td>
<td>3</td>
<td>3.597</td>
</tr>
<tr>
<td>Our senses</td>
<td>309</td>
<td>163</td>
<td>16</td>
<td>8</td>
<td>3.558</td>
</tr>
<tr>
<td>Bilharzia</td>
<td>313</td>
<td>169</td>
<td>17</td>
<td>8</td>
<td>3.552</td>
</tr>
<tr>
<td>Gardening</td>
<td>263</td>
<td>168</td>
<td>16</td>
<td>5</td>
<td>3.524</td>
</tr>
<tr>
<td>Conservation of natural resources</td>
<td>305</td>
<td>166</td>
<td>29</td>
<td>10</td>
<td>3.501</td>
</tr>
<tr>
<td>Grass</td>
<td>295</td>
<td>189</td>
<td>44</td>
<td>3</td>
<td>3.495</td>
</tr>
<tr>
<td>Nutrition</td>
<td>300</td>
<td>158</td>
<td>24</td>
<td>20</td>
<td>3.470</td>
</tr>
<tr>
<td>Plant growth</td>
<td>247</td>
<td>206</td>
<td>39</td>
<td>13</td>
<td>3.360</td>
</tr>
<tr>
<td>Litter/rubbish</td>
<td>234</td>
<td>161</td>
<td>45</td>
<td>22</td>
<td>3.313</td>
</tr>
<tr>
<td>Agriculture</td>
<td>242</td>
<td>194</td>
<td>52</td>
<td>24</td>
<td>3.277</td>
</tr>
<tr>
<td>Human body</td>
<td>202</td>
<td>193</td>
<td>37</td>
<td>38</td>
<td>3.189</td>
</tr>
<tr>
<td>Trees and wood</td>
<td>169</td>
<td>250</td>
<td>56</td>
<td>15</td>
<td>3.169</td>
</tr>
<tr>
<td>Mass</td>
<td>180</td>
<td>212</td>
<td>56</td>
<td>24</td>
<td>3.161</td>
</tr>
<tr>
<td>Home nursing/first aid</td>
<td>195</td>
<td>218</td>
<td>42</td>
<td>39</td>
<td>3.151</td>
</tr>
<tr>
<td>Time measurement</td>
<td>199</td>
<td>204</td>
<td>67</td>
<td>33</td>
<td>3.131</td>
</tr>
<tr>
<td>Air</td>
<td>170</td>
<td>223</td>
<td>79</td>
<td>24</td>
<td>3.102</td>
</tr>
<tr>
<td>Pollution</td>
<td>188</td>
<td>200</td>
<td>87</td>
<td>29</td>
<td>3.085</td>
</tr>
<tr>
<td>Local physical features</td>
<td>161</td>
<td>249</td>
<td>74</td>
<td>25</td>
<td>3.072</td>
</tr>
<tr>
<td>Properties</td>
<td>179</td>
<td>211</td>
<td>100</td>
<td>29</td>
<td>3.040</td>
</tr>
<tr>
<td>Climate</td>
<td>142</td>
<td>252</td>
<td>80</td>
<td>27</td>
<td>3.015</td>
</tr>
<tr>
<td>Energy</td>
<td>153</td>
<td>212</td>
<td>89</td>
<td>36</td>
<td>2.983</td>
</tr>
<tr>
<td>Mapping and direction</td>
<td>168</td>
<td>214</td>
<td>61</td>
<td>60</td>
<td>2.974</td>
</tr>
<tr>
<td>Wildlife and national parks</td>
<td>93</td>
<td>344</td>
<td>28</td>
<td>40</td>
<td>2.970</td>
</tr>
<tr>
<td>Poultry</td>
<td>143</td>
<td>229</td>
<td>106</td>
<td>27</td>
<td>2.964</td>
</tr>
<tr>
<td>Fire</td>
<td>157</td>
<td>204</td>
<td>98</td>
<td>40</td>
<td>2.957</td>
</tr>
<tr>
<td>Natural dyes</td>
<td>155</td>
<td>204</td>
<td>103</td>
<td>37</td>
<td>2.955</td>
</tr>
<tr>
<td>Sun</td>
<td>145</td>
<td>222</td>
<td>91</td>
<td>42</td>
<td>2.940</td>
</tr>
<tr>
<td>Changes</td>
<td>128</td>
<td>250</td>
<td>103</td>
<td>38</td>
<td>2.901</td>
</tr>
<tr>
<td>Simple machines</td>
<td>115</td>
<td>246</td>
<td>68</td>
<td>50</td>
<td>2.884</td>
</tr>
</tbody>
</table>
Table 4.—Continued

<table>
<thead>
<tr>
<th>Topic</th>
<th>Number of Responses</th>
<th>Mean Importance Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Important</td>
<td>Important</td>
</tr>
<tr>
<td>Basic electricity</td>
<td>114</td>
<td>196</td>
</tr>
<tr>
<td>Common plants</td>
<td>89</td>
<td>277</td>
</tr>
<tr>
<td>Population education</td>
<td>172</td>
<td>180</td>
</tr>
<tr>
<td>Animal husbandry</td>
<td>111</td>
<td>238</td>
</tr>
<tr>
<td>Balance of nature</td>
<td>126</td>
<td>216</td>
</tr>
<tr>
<td>(interdependence)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common animals</td>
<td>82</td>
<td>269</td>
</tr>
<tr>
<td>Baby care</td>
<td>150</td>
<td>151</td>
</tr>
<tr>
<td>Thunder and lightning</td>
<td>89</td>
<td>219</td>
</tr>
<tr>
<td>Simple geology</td>
<td>79</td>
<td>207</td>
</tr>
<tr>
<td>(rocks/minerals)</td>
<td>85</td>
<td>181</td>
</tr>
<tr>
<td>Building houses</td>
<td>56</td>
<td>176</td>
</tr>
<tr>
<td>Symmetry</td>
<td>44</td>
<td>169</td>
</tr>
<tr>
<td>Fish farming</td>
<td>44</td>
<td>169</td>
</tr>
<tr>
<td>Alcohol and drugs</td>
<td>89</td>
<td>114</td>
</tr>
<tr>
<td>Sex education</td>
<td>53</td>
<td>99</td>
</tr>
</tbody>
</table>
Strong views were expressed that Sex Education should not be included, nor should Alcohol and Drugs.

The results from the two questionnaires thus provided strong guidelines for the selection of the major content areas of the curriculum, and they were very meaningful and useful in other ways, too. For example, the incredible fact that not only were all of the questionnaires returned, but additional ones were sent in, indicated a tremendous interest in this area on the part of teachers, headmasters, supervisors, and education officers. The distribution and collection of the questionnaires was actually a very hazardous one due to the war situation so it was a great surprise and satisfaction to obtain the degree of cooperation that was so enthusiastically given. Some of the questionnaires contained additional letters in which various ideas and suggestions were offered and elaborated.

In addition, the results showed a tendency for teachers to offer their suggestions more readily in the form of topics than in the form of concepts or skills.

Meaningfully, sensitive areas such as sex education or alcohol and drugs were not favored for inclusion despite the fact that there was evidence that these were problem areas which needed attention. This result was not surprising because traditionally sex education was handled within the family, with the "ambuya" (grandmother) playing a major role.
Environmental Education Needs Expressed by Local Professional Environmentalists

In April 1977, a group of people, active in the field of conservation education, met in the Eastern Highlands of Rhodesia for a Conservation Awareness Workshop.

Some of these people were educators working with the Ministry of Education or with various departments of the University, while others were affiliated with other government departments such as National Resources Board, Department of Conservation and Extension, Community development or with private organizations such as Boy Scouts, Young Farmers Clubs, and Conservation Trust.

In June 1977, Professor Gilbert, Chairman of the Environmental Education Committee, sent a circular to all the participants of the workshop, inviting their consultation and ideas for the proposed Environmental Studies Curriculum (see Appendix C). Twenty-five responses were received, some of them in great detail. To indicate the range of proposals put forward, these were summarized under four headings: Overall Themes, Concepts, Attitudes, and Experiences. They were as follows:

1. Overall Themes
   a. Understanding "cause and effect" vis-á-vis "faith in outcome."
   b. Value and need of "planning ahead."
   c. Promotion of an awareness of man's interaction with total environment.
d. Man must be in balance with the eco-system which supports him.
e. Nature and protection of the environment and man as an integral part of it.
f. An understanding of conservation implies an understanding of quantitative measurement.

2. Concepts
a. Soil as a non-renewable source and fountain of renewable resources.
c. Soil as a "buffer system" preserving surface of earth from abrupt and wide fluctuation in temperature, water, and nutrients.
d. Behavior of soil types to differing conditions of plant cover, animal cover, heat, and water.
e. Basic principles of sound land use: the rapid loss of soil and its fertility and its slow reformation.
f. Importance of biological diversity in the transfer of energy and nutrients in a healthy ecosystem.
g. Interaction of soil, plants, and animals.
h. Degradation of the environment and ways of abating it.
i. Maintenance of natural resources through anti-pollution measures.
j. Importance of trees to man: usefulness, replacement, environmental significance.
k. Conservation and wise utilization of indigenous woodlands, including the planting of eucalyptus to replace dwindling indigenous woodlands.

l. Community/civic organization and responsibility.

m. Our town or city: an historical, geographical, architectural, biological survey.

n. National economics (emphasizing sources of government finance).

o. Family health and community health.

3. Attitudes

a. Realization that education does not end with schooling.

b. Appreciation of different racial attitudes to correct behavior--particularly regarding employer/employee relationships.

c. The way an individual uses his environment is influenced by his perception of that environment.

d. Positive attitudes (as opposed to "thou shalt not . . . " all the time) to "conservation" and "resources."

e. Realization that the conservation of resources is essentially a human consideration, not physical.

f. Everyone has responsibility for holding the natural bounty of the world in trust for succeeding generations.

g. Re conservation the instilling of an attitude of "love of nature" with young pupils probably more enduring than "knowledge."

h. Instilling an attitude of thrift.
4. Experiences

a. Promotion of a wide range of personal attitudes through a wide range of personal experiences—thematicallly structured—with immediate environment.

b. Program must stimulate pupils into action, e.g., natural history project, clean up campaign, donga reclamation.

c. Pupils to have a personal interaction with environment through the undertaking of a practical project.

d. Every child should have a conservation experience.

This range of proposals leaned heavily toward the protection of the environment, and did not reflect much concern for the pupils as such. The greatest emphasis was on the need for pupils to learn about their environment so as to promote conservation and understand man's role in relation to it.

Environmental Education Needs as Expressed by the Profession and Society Through Interviews and Meetings

Although the questionnaires were the more structured data collecting instruments, of great value in assessing the needs were informal and some formal interviews and meetings with administrators in education (i.e., education officers, supervisors, headmasters), members of the Education Development Unit of the Ministry, teacher trainers, and leading and interested members of the community at large. A list of those who participated in this exercise is provided in Appendix D. Important problems which have been identified through these interviews and meetings are as follows:
School Gardens. The Lewis/Taylor Commission suggested that school gardens should be retained because of their value in improving the quality of the environment and as a source of materials for science-based activities. However, all the headmasters and supervisors interviewed claimed that a good garden is a "show window" into the school, and a source of produce to the parents of the school children. Trials which could result in part of the garden being damaged or not growing well (such as water and compost trials) are generally not acceptable.

Grade 7 Examinations. All pupils of schools under the African Division of the Ministry of Education have to sit for the Grade 7 examinations in Shona, or Ndebele, English and Mathematics at the end of Grade 7. On the basis of these results plus performance or an aptitude test specially designed for this purpose, they will then be eligible or not for places at secondary schools. These places are very limited and during the last few years, the position has worsened (see Figure 3). Statistics show that in 1977 only 18.3% of those pupils leaving primary schools were able to get into secondary school, and only a total of 8.4% of children initially going to primary school were able to get into secondary schools.

Traditions and Customs. Specially in the urban areas, the incidence of unwanted pregnancies, venereal disease, and drunkenness is increasing (Gelfand, 1973). Concern for this situation was expressed during the interviews as well. The problem is that, to tackle these problems through education at school would involve the mention of
Expanding the System

Output
Grade 7

Intake
1st Year Secondary

1971
47,206
+12%

1972
53,018
+7%

1973
56,586
+9%

1974
61,848
+11%

1975
68,614
+14%

1976
78,338

24%

22.5%

22.3%

20.2%

19.2%

18.3%

11,356

11,939

12,591

12,591

12,545

13,168

14,350

+5%

+6%

+6%

-0.4%

+5%

+9%

Figure 3. The Gap Between the Output of Pupils at Grade 7 and the Intake at First Year Secondary School -- Statistics from Dock (1978, n.p.).
certain body parts and the introduction of topics which are literally taboo. This would mean going against accepted traditions and could offend people.

**Change.** During the last few years, the primary schools have had to adjust to several curriculum changes. A new English syllabus was introduced and this was followed by a new Mathematics syllabus. The initial reaction of a group of about 50 headmasters whose views were sought at a headmasters course at Domboshawa was "What, another change?"

As a result of these consultations, several needs have been identified which present special problems:

1. There is a need to re-direct the use of the school gardens so that they will not only provide a good image for the school, but also be a source of genuine educational experiences. This will probably involve an attempt to change attitudes of headmasters, teachers, and parents.

2. There is a special need to design the Environmental Science curriculum to be self-motivating because it will have to compete for time and effort against subjects which have the external motivation (and a very large one at that) of the Grade 7 external examination.

3. There is a need to make very definite decisions about the role of traditional beliefs and customs in the new curriculum. There is evidence that the transitional state of the country and urbanization of people has resulted in the breakdown of traditional forms of behavior and this has
given rise to large problems such as unwanted pregnancies, a large incidence of venereal disease, and excess drinking. The decision facing curriculum developers is whether to re-educate people about their traditions and customs, or to introduce western-type approaches, such as sex-education in the schools, in an effort to solve the problems. Bearing in mind the political climate which presently exists and the desire for a sense of identity and pride in cultural heritage, as expressed through interviews and questionnaires, there appears to be a strong case for educating pupils about traditional forms of behavior, specially those which will alleviate the present problems, and to support this with school experiences which do not contravene traditional mores.

4. There is also a need for a very careful assessment (i.e., pilot studies) as to how the Environmental Science curriculum plan will be introduced into the schools so as to minimize resistance to it which appears inevitable since it follows two very major curriculum changes.

Although it may be argued that some of these needs are not specifically the pupil's needs for environmental literacy, it is important to identify and meet system needs for providing an Environmental Science course too as it is the vehicle by which the pupil's needs will be met.
Environmental Education Needs Identified Through First-Hand Observation and Teaching Experience in the Classroom

A list of the schools in which observation and trial lesson exercises were carried out by the team members over a combined period of 7 months is included in Appendix E, and a checklist used in Appendix F.

One of the first and major impressions gained was of the tremendous job that the headmasters and teachers are doing. Working bilingually with large classes of between 40-46 pupils of mixed ability, and generally with limited facilities and resources, what they are accomplishing is incredible. The observations made, and presented in Table 5, were not for the purpose of being critical but only for the genuine purpose of identifying needs which could be met within the framework of an environmental science course, and with the sincere hope of being able to help enrich the general learning environment of the pupil, and facilitate the work of the teacher as much as possible.

What could have been a handicap became an advantage when it came to observation and teaching in the classroom. All three of the team members were experienced secondary school teachers, but completely new to the primary school scene. Thus there were no preconceived ideas. All observations were made with "new" eyes and ears. The introduction of approaches and topics at the various levels was guided by the literature, courses, and the teachers themselves, but because of the lack of experience, the team allowed a broader range in trying out material, than they might have otherwise. In addition, the team was susceptible to any stimuli in the classroom as it was a new
Table 5. Evidence of Needs as Identified Through Observation and Teaching in the Classroom

<table>
<thead>
<tr>
<th>Need</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. For knowledge about:</td>
<td></td>
</tr>
<tr>
<td>Hygiene</td>
<td>- runny noses, &quot;weepy&quot; eyes.</td>
</tr>
<tr>
<td>Nutrition</td>
<td>- symptoms of kwashiorkor evident in very young pupils.</td>
</tr>
<tr>
<td>Health</td>
<td>- uncovered sores, coughing, and sneezing children.</td>
</tr>
<tr>
<td>Trees</td>
<td>- a noticeable lack of trees in or surrounding school grounds, specially in rural schools.</td>
</tr>
<tr>
<td>Small animals</td>
<td>- none kept in classrooms, an inordinate fear of chameleons and lizards.</td>
</tr>
<tr>
<td>2. For using the following resources to provide educational experiences:</td>
<td></td>
</tr>
<tr>
<td>School garden</td>
<td>- whereas certain plants display namesigns, pupils are generally not encouraged to carry on investigations in the flower garden.</td>
</tr>
<tr>
<td>Outdoors (the veld)</td>
<td>- little evidence of field trips or use of outdoor learning environment.</td>
</tr>
<tr>
<td>Neighborhood and community</td>
<td>- no evidence of use of neighborhood for study projects.</td>
</tr>
<tr>
<td></td>
<td>- no evidence of coordination of school activities with on-going community development projects.</td>
</tr>
<tr>
<td>Display of children's work</td>
<td>- although very evident in the early grades, pupils' work displayed generally looked as if it had been up a long time.</td>
</tr>
<tr>
<td>Relevant posters</td>
<td>- a tendency to display posters distributed by the Audio-Visual services as decoration (sometimes inappropriate to age level at that grade).</td>
</tr>
<tr>
<td>Reference materials</td>
<td>- limited availability.</td>
</tr>
<tr>
<td>Useful &quot;rubbish&quot; articles (i.e., old newspapers, tins, plastic bottles, etc.)</td>
<td>- these are more evident in classrooms of Grades 1 and 2 than at higher grades.</td>
</tr>
</tbody>
</table>
Table 5.—Continued Evidence of Needs as Identified Through Observation and Teaching in the Classroom

<table>
<thead>
<tr>
<th>Need</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guest speakers and demonstrators such as parents and community</td>
<td>- none encountered during trials.</td>
</tr>
<tr>
<td>workers such as health assistant, nurse, etc.</td>
<td></td>
</tr>
</tbody>
</table>

3. For the development of the following skills and attitudes:

<table>
<thead>
<tr>
<th>Need</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questioning</td>
<td>- evidence of much teacher to pupil questioning, but hardly any pupil</td>
</tr>
<tr>
<td></td>
<td>initiated questioning.</td>
</tr>
<tr>
<td>Problem solving</td>
<td>- much of the pupil assessment was based on filling in the missing</td>
</tr>
<tr>
<td></td>
<td>words, or on answering memorized information.</td>
</tr>
<tr>
<td>Accurate measuring</td>
<td>- evidence of difficulty in describing quantitatively.</td>
</tr>
<tr>
<td>Recording</td>
<td>- large amount of time spent in laborious writing.</td>
</tr>
<tr>
<td>Appreciation of the environment</td>
<td>- noticeable lack of expressions about beauty and pleasure in relating</td>
</tr>
<tr>
<td>as a source of beauty and pleasure</td>
<td>to or describing features in the environment.</td>
</tr>
</tbody>
</table>

4. For making provisions for very slow pupils in each class:

<table>
<thead>
<tr>
<th>Need</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- the existing policy of automatic promotion has resulted in the</td>
</tr>
<tr>
<td></td>
<td>presence of at least one very slow group (roughly 15% of total in</td>
</tr>
<tr>
<td></td>
<td>each class).</td>
</tr>
</tbody>
</table>

5. For special language considerations:

<table>
<thead>
<tr>
<th>Need</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- trial teaching showed the need to communicate almost completely in</td>
</tr>
<tr>
<td></td>
<td>the indigenous language during the first two grades; at grades 3 and</td>
</tr>
<tr>
<td></td>
<td>4 there is still partial reliance in order to clarify ideas; only at</td>
</tr>
<tr>
<td></td>
<td>about grades 5 onwards can one rely completely on English as the</td>
</tr>
<tr>
<td></td>
<td>only medium.</td>
</tr>
</tbody>
</table>

6. For less emphasis on memorization:

<table>
<thead>
<tr>
<th>Need</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- much evidence of recitation and rote learning.</td>
</tr>
<tr>
<td>Need</td>
<td>Evidence</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7. For introducing more pupil-centered approaches:</td>
<td>- tendency for teacher to control classroom.</td>
</tr>
<tr>
<td></td>
<td>- tendency for pupils to wait for teacher's lead before engaging in any activity.</td>
</tr>
<tr>
<td>8. For making provisions for in-service teacher training and</td>
<td>- teachers were generally very enthusiastic &quot;learners&quot; in many of the activities, becoming themselves aware of some aspects of the environment for the first time.</td>
</tr>
<tr>
<td>opportunities for environmental encounters:</td>
<td></td>
</tr>
<tr>
<td>9. For considering more flexibility in pupil management:</td>
<td>- pupils were often so &quot;set&quot; in their methods of work and behavior that it created an unconscious resistance to different approaches.</td>
</tr>
<tr>
<td>10. For making full use of the cooperative attitude of pupils</td>
<td>- pupils listened eagerly to their teacher and vied with one another in carrying out small tasks.</td>
</tr>
<tr>
<td>toward the teacher and the school:</td>
<td></td>
</tr>
</tbody>
</table>
environment, and each member made a special effort to learn as much from it as possible.

The potential to enrich the present learning environment appears great, but so are the challenges. This is because while there is great room for improvement, the constraints toward the achievement of that improvement are very real.

Several of the needs identified point to the major challenge of altering the orientation of the pupils as to where to look for information. At present, the teacher and the textbook are looked upon as the only sources of information. The challenge is to instill in pupils the desire, and provide them with skills, with which they can look for answers to their inquiries in natural phenomena as well. In addition, it will be necessary to orient the teachers to their new roles as providers of learning opportunities as well as sources of knowledge.

Environmental Education Needs Arising from a Review of Current Geography, Science, and Gardening Courses

Geography Courses. Geography is taught from Grade 3 through Grade 7. The books recommended by the Ministry are Looking at Geography (College Press) or Children of Africa (Longman). Each child has a textbook and the teacher, a teaching guide. The books were first printed in 1971. They are well illustrated. In Looking at Geography: Grade 3, 14 out of 30 chapters deal with topics within Rhodesia (i.e., the store, garden, post office, a factory). The other chapters deal with children in other lands.
The consensus of opinion (sought through Questionnaire II, Part I, school visits, and interviews) is that the language level is adequate, illustrations are good, and the activities suitable. However, those chapters dealing with other countries, particularly those not surrounding Rhodesia are too remote to be interesting or of value at primary level.

No formal evaluation of the geography courses has been carried out. Pupil assessment is carried out by the teacher, and there is no external examination in this subject.

**Science Course.** Science is taught from Grade 1 through Grade 5. The books recommended by the Ministry are *Discovery Science* (Longman) Books 1 through 5. In Grades 6 and 7, Nature Study is taught and the recommended books are *Outdoor World: Book Four* (Longman) and *Outdoor World: Book Five* (Longman), respectively. From Grades 1 through 4 only the teacher has a book (actually the *Discovery Science* books are designed for use by the teacher). From Grades 5 through 7, a book for the pupil is optional, but is considered essential for the teacher.

The *Discovery Science* books are pupil centered and activity based. They are designed along the lines of the Minnemast Series and as such are concerned with the teaching of main ideas (e.g., properties, changes, cycles, symmetry). Gilbert (1976a, 1976b) described the grasping of main ideas as a major problem teachers face with this approach.

An informal survey on the *Discovery Science* course at Grades 3, 4, and 5 conducted in 1975 by the Education Development Unit of the
Ministry of Education in cooperation with the Science Education Centre, University of Rhodesia (Rhodesia 1975), yielded the following information:

1. The least successful course was Grade 4; the most successful, Grade 5.

2. The teachers like the material but find it difficult to understand and put into practice. This is primarily due to:
   a. Language difficulties (both in the case of children, and sometimes in the case of teachers not being able to cope with the language level required in the guide books).
   b. Apparatus availability. No kits were provided with the course, and teachers claim that too much is required which is difficult to obtain.
   c. New concepts. Much of the material and type of approaches are new to teachers.

3. The evaluation exercises which are part of the course are not being carried out correctly.

4. The lessons are generally too long.

5. Good points of the course are:
   a. Correlation with other school subjects.
   b. Learning by doing.
   c. Stimulation of curiosity.
   d. Valuable nature walks and group work.

Reports indicate that observations have shown a greater willingness by pupils to question ideas, events and beliefs, a tendency
toward more observation and resourcefulness, greater enjoyment of school work, and a greater awareness of the environment.

The courses for Grades 1 and 2 have been generally well received, but no formal summative evaluation has been carried out. The team's classroom observations showed that the activities were being enjoyed by both the teacher and pupils.

The two Outdoor World books used in Grades 6 and 7 are a radical departure from the Discovery Science approach. The books are very much information sources with a few suggestions for practical work. Some of the titles of the chapters are: The Animal Kingdom, The Praying Mantis, Peas and Beans, The House Fly, Plants That Eat Insects. The suggestions for practical work consist mainly of making lists of one thing or another, or observing something. The books were first published in 1947 and have not been revised since then. Pupil assessment is carried out by the teacher and there is no external examination in this subject.

In June 1976, Gilbert (1976a) carried out a survey of the Nature Study course, Grade 6, for the specific purpose of collecting information which would be used in the development of a new science or Environmental Studies course. Questionnaires (see Appendix G) were sent to a number of teachers and supervisors with the main purpose of assessing: (1) the extent to which the existing course was educationally supported, (2) the reasons for these views, (3) the sorts of changes which would be welcomed, and (4) what practices were being adopted by teachers in the classroom. The number and distribution of
the questionnaires sent out and the number and percentage of replies are shown in Table 6.

Table 6. Nature Study Course Survey: Questionnaires Sent Out and Replies

<table>
<thead>
<tr>
<th></th>
<th>Sent Out Matabeleland</th>
<th>Replies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>South</td>
<td>Midlands</td>
</tr>
<tr>
<td>Teachers</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Supervisors</td>
<td>12</td>
<td>16</td>
</tr>
</tbody>
</table>

Whereas reference to this survey will be made in other parts of this study, only those items which were of value in establishing content for the Environmental Science course are presented here.

Items 16, 17, 18, and 21 of the questionnaire related to the first purpose of the survey, the merit of the existing course. The responses are shown in Table 7. (The figures represent percentages. For those items where respondents have omitted a reply, totals of percentages for "Yes" and "No" are less than 100.)

In terms of subsequent usefulness, teachers and supervisors regard the existing course as appropriate in parts and inappropriate in others. Nevertheless, they would definitely welcome changes being introduced and think pupils would as well.

Items 18 and 21 asked the respondents to give reasons for their replies, and item 22 asked for any additional comment about the present
Table 7. Questionnaire Responses Relating to Merit of the Nature Study Course

<table>
<thead>
<tr>
<th>Item</th>
<th>Teachers</th>
<th>Supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>16 Does the course give children knowledge which will be useful to them when they leave school?</td>
<td>66</td>
<td>24</td>
</tr>
<tr>
<td>17 Does the course give children knowledge which will not be useful to them when they leave school?</td>
<td>54</td>
<td>38</td>
</tr>
<tr>
<td>18 The children would like the Nature Study course to be changed.</td>
<td>74</td>
<td>12</td>
</tr>
<tr>
<td>21 I should like to teach a different Nature Study course.</td>
<td>76</td>
<td>11</td>
</tr>
</tbody>
</table>

^a U = Uncertain.

Nature Study course. These reasons and comments were categorized into "favorable" and "critical." They are in Table 8.

Part II of the questionnaire sought the respondents' views on changes with regard to new topics, skills, and attitudes they would make to the present Nature Study course if it were to be broadened and possibly called "Science" or "Environmental Studies." The results are presented in Table 9.

For farming, the main reference was to the rearing of domesticated animals (especially poultry) and crop and fruit growing.
Table 8. Critical and Favorable Comments by Teachers and Supervisors Regarding the Nature Study Course

<table>
<thead>
<tr>
<th>Comment</th>
<th>Teachers (90)</th>
<th>Supervisors (16)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Critical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most of the topics are remote, not useful, not within children's experience, not related to after school life, etc.</td>
<td>32</td>
<td>5</td>
</tr>
<tr>
<td>Does not provide practical activity for the pupils.</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td>Limited to living things, narrow coverage of science.</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Level of English not suitable to pupils.</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Topics not of interest to pupils.</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Does not offer children opportunity to find out for themselves.</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Too difficult: too adult.</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Does not tie in with Discovery Science 3-5.</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Most specimens difficult to find.</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Out-of-date.</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>No links between topics: topics not graded in difficulty.</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Does not relate to Junior Certificate Science (next higher school level of science).</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>No opportunity for children to give own ideas.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Favorable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good, except for a few remote, useless topics.</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Most of the lessons are interesting and have bearing on needs and problems.</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Enjoyable.</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Very suitable for children in rural areas.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Helps subdue superstitions children might have about nature.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Satisfactory but needs to include latest references.</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
### Table 9. New Topics Recommended by Teachers and Supervisors to Include if Nature Study Course were to Become Environmental Studies

<table>
<thead>
<tr>
<th>Recommended New Topics</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teachers (90)</td>
</tr>
<tr>
<td>Farming</td>
<td>22</td>
</tr>
<tr>
<td>Nutrition</td>
<td>13</td>
</tr>
<tr>
<td>Soil and water</td>
<td>13</td>
</tr>
<tr>
<td>Conservation of resources</td>
<td>10</td>
</tr>
<tr>
<td>Air and pollution</td>
<td>10</td>
</tr>
<tr>
<td>Diseases and hygiene</td>
<td>8</td>
</tr>
<tr>
<td>Parts of the body</td>
<td>7</td>
</tr>
<tr>
<td>Rhodesian plants and animals</td>
<td>7</td>
</tr>
<tr>
<td>Meteorology</td>
<td>6</td>
</tr>
<tr>
<td>Power and energy</td>
<td>4</td>
</tr>
<tr>
<td>Electricity</td>
<td>4</td>
</tr>
<tr>
<td>Machines</td>
<td>3</td>
</tr>
</tbody>
</table>
Single references were made to weeds, fish farming, fertilizers, and veld management.

A substantial proportion (about one-third) of the teachers gave no examples of recommended skills or misunderstood what they were required to give. However, the skills given are listed in Table 10 in order of frequency of mention. Clearly teachers and supervisors recommend a course which is more practical.

Table 10. Skills Recommended by Teachers and Supervisors to Include if Nature Study Course were to Become Environmental Studies

<table>
<thead>
<tr>
<th>Skill</th>
<th>Teachers (90)</th>
<th>Supervisors (16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimentation (unspecified)</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Technical skills (e.g., measuring, using</td>
<td></td>
<td></td>
</tr>
<tr>
<td>instruments, collections, dissections)</td>
<td>18</td>
<td>4</td>
</tr>
<tr>
<td>Observation</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>Farming skills (e.g., growing crops)</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Studying plants and animals</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Recording</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Making things (e.g., cages, periscope)</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Drawing</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Discovering</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Drawing conclusions</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Graph making</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>
Only half of the teachers stated the attitudes they would want a broader Nature Study or Environmental Course to develop. Those mentioned were as shown in Table 11.

Table 11. Attitudes Recommended by Teachers and Supervisors to Include if Nature Study Course were to Become Environmental Studies

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teachers</td>
</tr>
<tr>
<td>Curiosity</td>
<td>45</td>
</tr>
<tr>
<td>Love of (interest in) nature</td>
<td>16</td>
</tr>
<tr>
<td>Scientific attitude (e.g., objectivity, honesty, doubt, if superstitious)</td>
<td>10</td>
</tr>
<tr>
<td>Venturesomeness</td>
<td>8</td>
</tr>
<tr>
<td>Responsibility for environment</td>
<td>5</td>
</tr>
<tr>
<td>Kind of animals</td>
<td>4</td>
</tr>
<tr>
<td>Resourcefulness</td>
<td>2</td>
</tr>
</tbody>
</table>

This survey brough to light certain important needs. First of all, it pointed out the need to replace some of the material now being taught in Nature Study because it is not considered useful by teachers and supervisors. Secondly, a strong opinion was expressed for the need to change the course. The two major criticisms of the existing course is its remotefulness from the child's life and experiences and its lack of provision for practical activities. In addition, heading the list of recommended new topics are farming, nutrition, soil and water; for skills, are experimentation and technical skills (e.g., measuring,
using instruments); and for attitudes, curiosity and love of (interest in) nature. All these recommendations indicate where the needs are, and it is imperative to take cognizance of these and make provision for meeting them within the framework of the new Environmental Science course.

**Gardening Course.** This course begins at Grade 3. At this level and at Grade 4, the pupils help with watering, weeding, and generally do physical labor. For use at Grades 5, 6, and 7, the Ministry recommends the book *How to Grow Vegetables* (Longman) for the teacher's use.

Every school visited by the team had a garden. Usually there was a flower garden at the front and a vegetable garden of one kind or another somewhere in the school grounds. Both are tended by pupils and every school visit showed pupil activity in the garden. The team's observations and interviews revealed that there is great interest in school gardening. It adds beauty and status to the school. It is a source of vegetables for some parents of the school children and thus a source of income to the school. It is also a means of punishment. This last observation is supported by research survey (Kileff, 1973).

The gardens vary in size according to the school size, resources, and location. The amount of work expended in them is considerable. In roughly 90% of the schools, water has to be carried to the garden as the source is a well or stream. The flower gardens are methodically laid out, with the names of the plants and trees displayed. The vegetable gardens are also methodically laid out, with different
classes being responsible for different beds. However, the team saw no evidence of experimental beds or of agricultural experiments being carried out.

There is no pupil assessment being carried out in this subject, nor is there an external examination.

**Definition of Aims and Objectives for the Course**

Objectives Recommended for Primary Education in General in the Lewis/Taylor Report

The Lewis Taylor Commission, on the basis of evidence presented to it, recommended that objectives for the primary system must now be designed to:

(i) provide a basis both for further formal and informal education whilst also being a terminal course.

(ii) relate more closely than hitherto to the needs of both the child and the community; and

(iii) make provision for the continued expansion of primary education as opportunity offers.

In doing so, the introduction of changes must take into account:

(i) the suitability or otherwise of the current curriculum;

(ii) the status and professional competence of the present teaching force;

(iii) the likely type of professional training of new entrants to the teaching profession;

(iv) in-service training needs;

(v) the provision of supervisory personnel;

(vi) the need to retain and strengthen public confidence in the system (Rhodesia, 1974, p. 5).
Broad Objectives Recommended in the Lewis/Taylor Report for Environmental Science

The Commission recommended the introduction of the study area Environmental Studies: Physical (Environmental Science), as a step toward reducing the current fragmentation of syllabuses and to make the curriculum more relevant to the pupils' needs. The broad objectives of these studies they recommended would be:

(i) to give an understanding of the delicate balance of nature;

(ii) to give an insight into the interdependency of man and nature;

(iii) to develop an appreciation of the need to use natural resources with a proper balance between their exploitation, maintenance, and conservation; and

(iv) to assist in developing an understanding of and competence in those habits necessary for healthy living in the local environment (Rhodesia, 1974, pp. 14-15).

While not included in the broad objectives, the Commission suggested a very close look at methods of approach to environmental studies as these are crucial "if the appropriate skills--such as those being able to seek out, collect, collate and analyse data; to report on and reproduce data; to draw and make models; to display and discuss their findings--are to be developed in the children as opposed to an ability merely to regurgitate memorized data and respond to sterile quiz programmes" (Rhodesia, 1974, p. 15). Thus, the acquisition of these study skills must also be considered an important objective.
Suggestions for Objectives from Teachers
Through Questionnaire I

Relevant information obtained through Questionnaire I which has relevance to the formulation of objectives for the course includes these facts:

1. The three most frequently suggested topics were soil, water, and the conservation of natural resources.
2. Nutrition was the fourth most frequently suggested topic.
3. Although the questionnaire asked for suggested topics or main ideas for inclusion in the curriculum, the large majority of the results gave suggestions of topics for learning about the environment.
4. The questionnaire returns were excellent—94% plus an additional unasked for 98 returns.

That soil, water, and conservation of natural resources were the most frequently suggested topics indicates a strong concern for wise management of our resources. As curriculum planners, we must capitalize on this concern. The strong emphasis on the topic nutrition is evidence of the problem of malnutrition which exists, and of an interest to combat it at the primary school level. Also, of great significance is the fact that with such an open-ended questionnaire and an appeal for suggested topics or main ideas, the majority of suggestions were content-centered, rather than concept-centered. This probably indicates a greater familiarity with content-centered courses. Finally, the excellent returns, plus the extra returns indicate a tremendous interest and willingness by teachers to participate in
the development of curriculum, and an efficient and cooperative attitude within the administration.

Objectives for Environmental Education as Suggested by the Literature in General

The objectives for environmental education vary according to the interests and values of those advocating teaching about the environment. The sharpest division is found between the conservationists who want the objectives for environmental education set firmly on the promulgation of the wise use of natural resources and the educationists who generally see education as a process stimulated or hindered by environmental experiences (Martin, 1975). The conservationists represented by people like Mellowes (1972) and Terry (1971) generally have a sense of urgency deriving from the threat of an ecological crisis. They would like to see the development of an "environmental ethic," a moral relationship of people toward the environment that would determine the way they should use the earth's natural resources. This is seen by Colton (1972), the Director of the Schools Council Project Environment, as the ultimate goal of environmental education.

An international survey carried out by the International Bureau of Education, a UNESCO organization, collected and analyzed replies to data from questionnaires from 79 countries. The results showed general agreement that the study of the environment provided rich educational experiences and opportunities for training in observation and the encouragement to think, compare, analyze, synthesize, and research. In addition, a love and respect for nature was acquired (Martin, 1975,
page 23). This type of study provides support for the educationists who want to see the objectives for environmental education firmly based in the area of child development. Yet, even among these educationists, a distinction is made between learning from an environment and learning about an environment. Watts (1969) referred to learning from an environment "applied" environmental studies. The aim here is to select learning situations using the environment to bring about the achievement of purely educational objectives. Robson's objectives for his Discovery Science program now being used in Rhodesian primary schools are along these lines. Watts then refers to learning about the environment as "pure" environmental studies. In this case the central objectives is the acquisition of knowledge about the environment. The environment provides the learning situations in which a range of skills can be developed to achieve the desired knowledge.

More recent improvements to Watts's version of environmental studies have come from educationists who have advocated that in addition to observing, recording, and analyzing, pupils should be motivated to feel a concern for the environment and should be made aware of the need to be involved in conservation activities (Martin, 1975).

In England, the School Council Project devoted much time and effort to the formulation of appropriate objectives for primary school science. They provided guidelines to help teachers and curriculum workers match activities with objectives. Their emphasis is that what needs to be determined is how to help pupils learn, not what to teach them (Ennever and Harlen, 1972).
The main finding here was that while study of the literature indicated that there appeared to be no "set" objectives for an environmental education course, it is of great value to study the formulation of objectives in various programs concerned with environmental education primarily because it helps to discern areas of emphasis in the various programs. This helps the curriculum planners to focus on the areas of emphasis advocated in their particular situation and to formulate the objectives accordingly.

Analysis of the data collected in this study showed the Conservation Awareness Workshop participants to be very much conservationists. Throughout their recommendations, there was a great preoccupation with the ecological balance and a desire to develop new and better attitudes toward the environment and man's relationship with it. On the other hand, teachers, supervisors, teacher trainers, and education officers showed very definitely educationist leanings. The Lewis/Taylor recommendations were also along educationist lines of thinking.

Since, for a large majority of the children, a primary school education is the only schooling they may probably have, it was decided to adopt an educationist approach. That is, to focus on studying about the environment and in so doing provide rich educational experiences and opportunities for the acquisition of basic concepts and skills and the development of constructive, positive attitudes toward the conservation of the environment and an improvement in the quality of life.
Aims and Objectives for the Environmental Science Course as Defined by the Environmental Science Working Party

It has been generally accepted that education should be concerned with both cognitive and affective domains (Krathwohl, Bloom, and Masia, 1964). To meet the need for evaluating learning experiences then, directed at both the cognitive and affective domains, environmental educators are increasingly seeing the utility of stating their objectives in measurable behavioral terms. For instance, Swan (1971, p. 46) stated, "Since the intent of environmental education is to see . . . attitudes manifested in behavior, we should attempt to direct our evaluative techniques towards measuring behaviors."

Mager (1975) provided a useful set of guidelines for writing behavioral objectives. He wrote that "An objective is an intent communicated by a statement describing a proposed change in a learner—a statement of what the learner is to be like when he has successfully completed a learning experience . . . (Mager, 1975, p. 3). It involves describing what the learner will be doing when demonstrating that he "understands."

In trying to determine how best to state the objectives in this case, the team considered arguments for and against behavioral objectives. The case for explicit behavioral objectives is as follows:

1. Since the purpose of instruction is to change behavior, the objectives of instruction should state, specifically and overtly, the performance one wants the learner to be able to demonstrate.
2. Communication among all of those involved in the schooling process is greatly enhanced by the use of behavioral objectives.

3. Behavioral objectives indicate clearly what it is the teacher should do in providing classroom experiences to enable students to achieve a goal (they provide direct, useful guidance).

4. The school becomes more efficient (easier to select learning experiences to achieve specified objectives). The pupil knows what he is expected to accomplish.

5. Behavioral objectives may be stated for an individual pupil or for small groups.

6. They provide the only meaningful basis for evaluating the outcomes of instruction (criterion-referenced tests are possible).

The case for broader, non-explicit goals is as follows:

1. Human behavior in actuality is much broader in scope and purpose than the sum of specific bits of behavior learned in isolation. (Behavioral objectives fail to take account of the higher levels of functioning).

2. Behavioral objectives disregard the broad, interrelated categories of human activity (fail to take into account long range goals of education).

3. They restrict the scope and significance of instruction, greatly reduce the flexibility and freedom of the teacher and the group.
4. The task of preparing behavioral objectives is endless.

5. They destroy the opportunities for students and teachers to engage in choice making, in probing alternative courses of action, testing intuitive hunches, etc.

6. In stating behavioral objectives, one ignores the probability and possibility of concomitant learnings (pupil learns other things than the stated objective).

As a result, it was decided to follow the approach suggested as follows in stating the aims and objectives of the Environmental Science course:

1. To state the general aims in broad, abstract terms, but still define the nature and character of the program and indicate what kinds of growth and development should be fostered.

2. To state broad objectives for each domain in much more explicit terms and specify outcomes in the form of attainments or characteristics of behavior that pupils should acquire as a result of the program.

3. To derive more specific behavioral objectives from the broad interim objectives. These then will constitute the basis for selecting the specific learning activities.

Thus, after analyzing the results of the needs assessment, studying about the formulation of objectives in general and for environmental studies specifically, reviewing the objectives recommended by the Lewis/Taylor Report for Rhodesian primary schools in general and for the Environmental Studies: Physical course (now called Environmental
Science), plus agreeing on a basic philosophy, the team was ready to formulate the broad general aims of the course. These are:

1. To make pupils aware of the ecological inter-relationship of the physical and biological factors what make up the environment, and of man's relationship to it.

2. To motivate them to responsible action toward better management of the environment so as to ensure survival and improve the quality of life.

3. To provide them with basic skills and concepts in science, gardening, and geography.

4. To foster the development of positive interests, attitudes, and aesthetic awareness of the environment.

The definition of the broad or interim objectives (the outcomes desired within each domain) is provided in the draft curriculum plan in Chapter 6. Finally, the formulation of instructional objectives has been a much slower process and one that is still ongoing. These are formulated as each lesson within a unit is developed.

The following model (Figure 4), a modification of one provided by Saylor and Alexander (1974, p. 153), shows the process adopted for defining the aims and objectives of the course.

**Analysis of Alternate Ways to Meet Needs**

It appears to be commonly accepted that educational curricula should be designed to help society solve its problems. On the other hand, it is important to promote the idea that society must not only look to the schools as a way to correct present problems. Therefore,
Figure 4. The Process of Defining Goals and Objectives — Adapted from Saylor and Alexander's (1974, p. 153) model.
after identifying some of the environmental education needs, it was necessary to look for possible alternate ways for meeting these needs outside the schools. An informal investigation was conducted to obtain information about the purposes and activities and target populations of some of the major organizations and agencies in the country concerned with environmental issues. The schedule in Appendix H was used for collecting information during a series of interviews with officers of these organizations. A brief resume of these data is presented in Table 12.

Looking at this list of organizations and agencies concerned with environmental issues, one realizes that most of them direct their efforts toward adults. The ones that reach more African primary school children are Young Farmers Clubs, Boy Scouts, and Girl Guides.

The Young Farmers Clubs were established in Rhodesia in 1951 and modelled after the Young Farmers Clubs of Great Britain and the 4H Clubs of the United States. They are particularly active in the rural areas, and place great emphasis in providing non formal training in such areas as farming, vegetable gardening, poultry and rabbit management, leatherwork, and domestic skills for unemployed youth who have left school after Grade 7. They also aim to encourage the conservation of natural resources. They often work in conjunction with chiefs and councils in the rural areas and have manpower and financial support from the Government. Although their membership reached 100,000 in 1975, the war has resulted in a sharp drop in members.

The 1977 census for Girl Guides showed a membership of 10,731, of which 9,909 were African, while the Boy Scout figures were 5,569.
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Producers/Publishers</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Nature of Literature Produced</td>
<td>Yes (for pupils)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (for pupils)</td>
<td>Yes</td>
</tr>
<tr>
<td>Level for which Literature is Produced (Adult/Youth)</td>
<td>Adult</td>
<td>Adult &amp; some materials for primary school children</td>
<td>Primary school level</td>
<td>Adult</td>
<td>St. 5 (Grade 7 equivalent)</td>
<td>Adult</td>
</tr>
<tr>
<td>Would speakers be available to visit primary schools if invited?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Can it provide sites for visits or field trips?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>T.I.L.C.O.R.</td>
<td>Dept. of Conservation &amp; Extension</td>
<td>Dept. of National Parks &amp; Wildlife</td>
<td>Atlantica Ecological Research Station</td>
<td>Young Farmers Clubs</td>
<td>Natural Resources Board</td>
<td>Forestry Commission Advisory Service</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------------------</td>
<td>----------------------------------</td>
<td>----------------------------------</td>
<td>--------------------</td>
<td>------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Tribal Trust Land Development Corporation Training Branch</td>
<td>promotes conservation awareness in youth</td>
<td>maintains &amp; operates National Park, protects flora &amp; fauna, promotes conservation</td>
<td>carries out ecological research, encourages conservation education in secondary schools</td>
<td>provides non-formal education, on farming, crafts, domestic skills to upper primary &amp; school leavers up to age of 30</td>
<td>promotes awareness of need to utilize all natural resources wisely</td>
<td>advises on Forestry as an industry &amp; on reforestation</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes (for members mainly)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ongoing rural development projects</td>
<td>environmental information on flora, fauna &amp; on National Parks generally</td>
<td>--</td>
<td>--</td>
<td>varies-- usually information on farming &amp; gardening techniques, crafts, money-making schemes</td>
<td>information on Natural Resources</td>
<td>technical bulletins on nursery work, plantations, etc.</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>--</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adult</td>
<td>Adult</td>
<td>Adult</td>
<td>--</td>
<td>Youth &amp; Young Adults</td>
<td>Adult</td>
<td>Adult</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Again, these figures reflected a sharp drop from two years previous. Nevertheless, their efforts to promote citizenship, character development, and environmental conservation are achieving results.

An analysis of the purposes and activities of these various organizations points to the fact that since most of the help is directed toward adults, this places a greater responsibility on the school for environmental education. Another possibility is to enlist the aid of these organizations in promoting environmental awareness and concern and encourage their diversification and expansion of activities to provide more links with youth and with the schools. This avenue is a very promising one, and even during our interviews, which were not initially intended for that purpose, great interest was shown in this direction. Here are some instances: A resource person from the Department of National Parks, helped in the development of a unit on wildlife, and the Department has just completed a film on Conservation Education which they will make available for schools. They are also willing to provide speakers and facilities for outdoor experiences.

The Department of Conservation and Extension has now extended its activities, once primarily concentrated on white Standard 5 (Grade 7 equivalent) pupils, to all schools and are actively providing help with in-service teacher training in conservation education.

Rhodesian Education Courses in Conservation of the Environment (R.E.C.C.E.) are considering changing from providing outdoor experiences to pupils (primarily white Standard 5 pupils) to providing outdoor education courses for primary school teachers in general.
During the past year, the Ministry of Health's Chief Education Officer worked closely with the Environmental Science and the Environmental Social Studies Working Parties in the production of a booklet on health education to be introduced into the schools, as part of their second term curriculum in commemoration of the Year of the Child. Previously, most of the health education efforts of this Ministry had been put into community development and therefore, adults.

All in all, one concludes that for the present time, the greatest responsibility for environmental education of children has to be taken by the school within its curriculum. However, it is recommended that action be taken to encourage as many outside agencies as possible to support the schools' endeavors in this direction and thus provide specific experiences and facilities which are not within the schools' realm. This, from present evidence, appears to be a course of action which would be profitable in terms of meeting some of the needs for environmental literacy.

System Components

As a result of all the procedures employed in this study, the following components were selected for the Environmental Science Course.

Philosophical Basis

Some thoughts from well-known educationists which have provided the philosophical basis for the course design are:

1. Froebel's belief that understanding of the nature and purpose of anything is dependent on the appreciation of its
relationship with other things. A child must study things in their natural "connexion" (Perry, Jones, and Hammersley, 1974).

2. Montessori's claim that it is very important for the child to be active in the learning process (Perry et al., 1974).

3. Piaget's contention that for a child to learn efficiently, he must organize his material and adapt himself to the things and information around him. Therefore, there must be continuous interaction between the learner and his environment, for as he is involved in new experiences his mind is altered and a picture of the world is gradually built (Piaget, 1962).

4. Swan's belief that people learn most eagerly when they recognize that the result of their learning will benefit them (Swan and Stapp, 1974).

5. Bruner's finding that a child can learn anything at any level, if only at the intuitive conceptual level. This forms a basis for further higher order concept development (Bruner, 1960).

6. Pestalozzi's idea that when a teacher has grasped a starting point, he can, given a certain amount of basic knowledge, educate himself through observation and self-practice. He can then help pupils to learn in the same way (Perry et al., 1974).

7. Stapp's claim that our environmental problems stem from our inability to develop a system of social values, life styles, and institutions which enable us to live in harmony with the environment (Swan and Stapp, 1974).

8. Maslow's contention that in seeking happiness and meaning from life, man strives to satisfy a hierarchy of needs. If he can
be truly in touch with his needs and fulfill the more basic ones, i.e., food and water, he will then strive for those values in life such as truth, beauty, justice (Maslow, 1970).

**Philosophy for the Course.** From the above and similar thoughts, the philosophy for the course was written as follows:

We accept that people learn. They acquire knowledge, skills, and attitudes, and they manifest this learning through modified behavior.

We accept that they learn best when they are involved actively and happily in the learning task or experience, and when they can see that the learning benefits them.

We accept that instruction is for the purpose of helping the individual to learn, and that therefore it must be based upon knowledge of how human beings learn and on the assumption that systematically designed instruction can greatly affect individual development.

Therefore, we accept that learning must be planned so that each person will come closer to the optimal use of his own talents, enjoyment of life, and integration and harmony with his physical and social environment.

We believe that the local environment provides the best medium for instruction. It is available, and therefore continuous interaction is possible; it is delicately balanced, and so study of interdependence is meaningful; it is beautiful and variable, and so expression to describe it is necessary; it is quantifiable, and so measurement makes sense; it is a living laboratory, and so avails concrete examples
of the laws and principles of science which young children can understand; it is vulnerable to man's impact and neglect, and therefore concern can be aroused and responsible action toward its care motivated.

Broad Aims of the Environmental Science Course

The broad aims of the course were set as follows:

1. To make pupils aware of the ecological inter-relationship of the physical and biological factors that make up the environment, and of man's relationship to it.

2. To motivate them to take responsible action toward better management of the environment so as to ensure survival and improve the quality of life.

3. To provide them with basic skills and concepts in science, gardening, and geography.

4. To foster the development of positive interests, attitudes, and aesthetic awareness of the environment.

Arguments have been presented for and against content based courses (Harlen, 1978). Due to the fact that many teachers are experiencing difficulties in coping with the present concept-based science course, and in accordance with their expressed preference, this environmental science course was designed to be content-based and pupil centered. The environment will serve as a topic umbrella under which basic concepts, skills, and attitudes will be developed.
Content Areas

Six major content areas were identified:

1. Natural Resources—Water, Soil, Grass, Trees, Minerals, Air, Fuel (wood, coal, oil), Sun, Wildlife, People.

2. Agriculture—Crops, Animals (including livestock, poultry, rabbits), Land Management, Irrigation, Contours, Terracing, Food Pests, Storage of Crops, Plant and Animal Products.

3. Health—Personal Hygiene, Toilets, Nutrition (diet, kwashiorkor, marasmus), Disease (disease carriers, measles, flu, gastro-enteritis, bilharzia, malaria, cholera, etc.), Immunization, First Aid, Healing, Child Care.

4. The Physical Environment: Natural—Land Forms (hills, rivers, etc.), Weather, Sun, and Cosmos.

5. The Physical Environment: Man-Made—Tools and Simple Machines, Materials we use, Infra-Structure (transportation, communications, etc.), Pollution.

6. Body Systems—(for moving, for getting energy from food, for making more people, for removing waste matter).

Concepts Underlying Content

A tremendous amount of research has been conducted, and material written about concept development in children. The works of Piaget and Bruner have been found to have great implications for science education.

In Africa, replications of various phases of Piaget's experiments have been carried out in various countries: Price-Williams (1969) studied children in Northern Nigeria and reported that by the
age of eight, all of them had attained conservation of both continuous and discrete quantities. Greenfield (1966) carried out a study on conservation and culture in Senegal using a selection of Piaget's tests. She found that school experience was significant in the attainment of the ability to conserve. Approaches to problems of conservation differed qualitatively between schooled and unschooled children. Ohuche (1974) studied children in Sierra Leone, while Otaala (1971) worked in Uganda. Also many interesting studies were carried out by the Human Development Research Unit, Institute for Social Research at the University of Zambia. While these replication studies have varied in methodology and detail, in general they have supported Piaget's position that cognitive development occurs in stages, with a transitional period falling between a pre-operational stage and a period of operational thinking.

In Rhodesia, both Hendricks (1966) and Orbell (1970) studied Rhodesian African school children in the carrying out of Piagetian tasks. Both also provided evidence that the Piagetian model is not culturally specific, but that it appears to be more or less a universal description of cognitive development. The level of performance, however, was lower in the Rhodesian children studied by Orbell (1970) than would be expected according to the Piagetian model.

Piaget and his followers have suggested that there is a very definite order in the successive patterns of behavior and thought. Basically, the mental development of the child appears as a succession of three great stages (Piaget and Inhelder, 1973). There is considerable overlap between stages, and the ages at which a child may achieve a
particular stage, varies; nevertheless, the three stages through which children pass are:

1. **Stage of pre-operational thought** (roughly between ages of 1 to 7)—this is re-divided into pre-conceptual and intuitive sub-stages. Language development occurs slowly and then more rapidly in this period. The child begins to be able to give reasons for actions and beliefs and to form some simple concepts. His thoughts are egocentric and he moves from particular to particular, without the ability to generalize.

2. **Stage of concrete operational thought** (approximately between 6 or 7 to 12)—the child begins to think logically about the real world, but his thinking is tied to concrete situations. Later he begins to classify and is able to give reasons for his classification. Still he is tied to understanding things he can see and manipulate, or easily imagine.

3. **Stage of formal operational thought** (entered at approximately 12 to 13 years)—the child begins to be able to deal with propositions as he was able to deal only with concrete objects in the last stage. He should be able to think in hypothetical terms and be able to anticipate consequences of actions taken to solve problems.

Piaget explains the transition from one stage to another in terms of four factors: maturation, or the increasing differentiation of the nervous system; social transmission, or the transfer of information
from person to person; experience with one's environment; and "equilibration" or self-regulation.

Piaget's work has implications for the content, method, and sequencing of the Environmental Science curriculum. One must seek knowledge of the child's stage of development, and knowledge of objectives, materials, and activities suited to various stages of development, so that they will be appropriately matched in the curriculum.

Bruner, whose contribution to discovery learning is often seen as an "outgrowth of the developmental work of Piaget" (Ohuche, 1974, p. 18) maintains that "any subject can be taught effectively in some intellectually honest form to any child at any stage of development" (Bruner, 1960, p. 33). This must mean that one can take most concepts, reconstruct them, and make their structures fit the cognitive structure of the child. In addition, Bruner contends that the child progresses from manipulation of materials through dealing with pictures and mental images to dealing with symbols, logic, and language.

In the design of the course, various concepts were selected as being fundamental. This was accomplished through study of the literature and consultation with teacher and teacher trainers. They were as follows:

<table>
<thead>
<tr>
<th>mass</th>
<th>scale</th>
<th>cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>volume</td>
<td>time</td>
<td>decay</td>
</tr>
<tr>
<td>growth</td>
<td>heat</td>
<td>systems</td>
</tr>
</tbody>
</table>
In sequencing the content throughout the seven years, each concept was kept in mind, and activities planned within the various topics to give opportunity for laying down the basic links and discriminations at the appropriate stage, so as to facilitate the development of higher order concepts at the higher grades or at secondary level. The learning of each concept (e.g., properties) was reinforced by presentation in different structures at different levels and across various topics.

Skills and Attitudes

A list of skills was compiled in the same manner as for concepts, and provision was made for the acquisition and practice throughout the planned activities from Grade 1 through Grade 7. These skills were:

- measuring
- observing
- classifying and sorting
- recording
- collecting
- detecting
- questioning
- mapping
- role playing
- simplifying
- modeling
- miming
- selecting
- estimating
- drawing
experimenting    manipulating    interpreting
investigating    problem solving    hypothesizing
comparing        describing       predicting
communicating

Formal planning for "teaching" attitudes was found to be a much more difficult exercise. Nevertheless, each planned activity was designed to foster a particular attitude (sometimes positive, sometimes negative), create a particular interest, or contribute to aesthetic awareness of the environment.

Methods and Strategy--Possible Approaches

The emphasis will be to obtain as much pupil participation as possible and to move away from a teacher-dominated classroom. Communication is to be encouraged in as many forms as possible. Some of the suggested approaches which have come from teachers, supervisors, headmasters, teacher-trainers and from the team, and which have been used in the trial lessons and found to be feasible were:

1. Cards with questions--for discussion by pupils within a group.
2. Reporting by a member of a group to other groups.
3. Tummy-stick figures to make drawing by teachers and pupils easy and fun. (Possibly use a set "family" throughout.)
4. Action drawings. Draw together, teach, add to drawing, e.g., dress up tummy-stick figure with animal products.
5. Flow diagrams. Information in point form in block or bubble, arrow to further unit of information.

6. Cross section diagrams in one plane.

7. Hook-ups. Main idea in center, sub-concepts or allied ideas hooked onto it.

8. Label making by pupils to summarize information on diagram or chart.

9. Use of outdoors and school grounds for observation, finding out, collecting and recording information, etc.

10. Short visits to nearby areas, e.g., market, vlei, stream, etc.

11. Games--quick games and long-term games.

12. Role playing.

13. Chart making--in groups.

14. Collecting information by survey, e.g., asking people.

15. Personification, e.g., what is the plant saying?

16. Singing, e.g., to reinforce a concept.

17. Story telling.

18. Charts which are built up, e.g., Bilharzia cycle.

19. Using models, e.g., small mound to represent real hill.

20. Interpreting photographic and pictorial information.

21. Describing by writing.

22. Recording in tables, charts, histograms, etc.

23. Cards with tasks--for individual work.
Anticipated Role of the Participants

It is anticipated that the role of the teacher regarding teaching approaches will be to:

1. Arouse the pupils' interest in their environment and to raise challenging problems in connection with it.
2. Discuss with pupils approaches to problems or topics for the purpose of encouraging pupils to select their own learning experiences where feasible.
3. Organize the working groups in a flexible way.
4. Monitor and guide the progress of pupils.
5. Initiate and develop discussion and debate.
6. Encourage each group of children to report or explain their work to the rest of the class.
7. Draw together the various aspects of the work and to summarize the results.

With regard to use of resources, the role of the teacher will be to:

1. Make available reference material for the pupils' use.
2. Provide and build up a collection of materials for practical work.

In linking with the community, the teacher's role will be to:

1. Arrange and structure visits or expeditions.
2. Arrange for visiting speakers from the community when possible and appropriate.
3. Regularly display ongoing work produced by pupils and to occasionally mount exhibitions for the community.

4. Link activities in the classroom with ongoing community development projects and problems.

The role of the pupil will be to:

1. Inquire, investigate, and discover for himself.

2. Extract information from reference materials (pictures, maps, books, newspapers, etc.).

3. Learn to work as an individual and cooperatively as a member of a small or a large group.

4. Suggest approaches to topics, where appropriate, and to set simple goals for himself.

5. Recognize the quality of his own performance in the light of his ability.

The role of the school will be to:

1. Provide resources and facilities within and outside the classroom and a flexible teaching schedule to enable pupils to explore their environment through their senses, bodies, and minds.

2. Become a place for pupils to develop and clarify beliefs, attitudes, and values that will enable them to live in harmony with their environment.

3. Inform pupils about emerging environmental problems and about appropriate action to help solve or preclude them.
Language, Grouping, and Time

The medium of instruction needs to be English. This is specified by the Ministry. It is also seen as desirable by both parents and teachers (Kileff, 1973). The Grade 7 examinations are in English, and opportunity must be provided in all courses for its learning and practice. Also, it is found that some scientific concepts are not able to be expressed in the vernacular languages (Strevans, 1976). However, specially in the first three grades the teacher will be encouraged to use the home language when necessary to ensure good communication.

With regard to grouping, the generally limited facilities and large number of pupils per classroom limit the desirable grouping flexibility. There is no opportunity for quiet, individual seating unless it is outside the classroom in the school grounds. Also, due to the fact that pupils are seated on benches, around tables, it is difficult to vary this arrangement very much. Nevertheless, planned activities call for different sizes of groups at various times, and for whole classroom participation, at others, and even for individual activities. The emphasis will be on flexibility as much as possible.

The curriculum will serve as a core which is envisaged to take up to 2/3 of the allotted time in the schedule for Environmental Science. The other third of the time will be left for the teacher to plan. The individual teacher will make the decision whether he or she will use that time to extend the core, devote more time to practical gardening, or review, or plan new activities.
The curriculum plan for the core will provide units of lessons on specific topics, and will list behavioral objectives to be achieved in each case. Within each unit, there will be optional activities or lessons for the achievement of these objectives. Provision will be made for "scientific" gardening within the core time, too.

Analysis of Resources Available, Resources Required and Constraints

As a result of first hand observations; trial teaching in schools; interviews with supervisors, headmasters, and teachers; review of available statistics; and an informal survey of possible community resources, a picture of the resource situation was obtained.

Resources Available

An investigation was conducted to determine the human and the physical resources which are available.

Teachers. The Annual Report of the Secretary for African Education gives the figure of 20,565 primary school teachers in 1977. Over half of them teach in primary schools in the Tribal Trust Areas under the authority of African Councils. Table 13 shows their professional qualifications. These data show that over one-half of the teachers have had no more than 8 years of schooling.

Part I of Questionnaire II provided the data presented in Table 14. These figures show that our sample is fairly representative in that it also shows approximately half of the teachers with 8 years of schooling. Roughly half of them have between 10-20 years of teaching experience.
Table 13. Professional Qualifications of Primary School Teachers in the African Division of the Ministry of Education in 1977

<table>
<thead>
<tr>
<th>Professional Qualification</th>
<th>Total Years of Schooling</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Per Cent of Total Teaching Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.T.L./T4 (2 years post Standard 6)</td>
<td>8</td>
<td>7,401</td>
<td>3,997</td>
<td>11,398</td>
<td>55.4</td>
</tr>
<tr>
<td>P.T.H./T3 (formerly 2 yrs. post RJC, now 3 yrs. post &quot;O&quot; levels)</td>
<td>10-14</td>
<td>4,741</td>
<td>1,570</td>
<td>6,311</td>
<td>30.7</td>
</tr>
<tr>
<td>T.2 (3 yrs. post &quot;O&quot; level)</td>
<td>15</td>
<td>44</td>
<td>17</td>
<td>61</td>
<td>0.3</td>
</tr>
<tr>
<td>Untrained</td>
<td></td>
<td>1,645</td>
<td>1,150</td>
<td>2,775</td>
<td>13.6</td>
</tr>
<tr>
<td>Combined Total</td>
<td></td>
<td>13,831</td>
<td>6,734</td>
<td>20,565</td>
<td>100.0</td>
</tr>
</tbody>
</table>

RJC = Rhodesian Junior Certificate (8 yrs.).

"O" level = Ordinary Level Certificate (11-12 yrs.).
Table 14. Professional Qualifications and Years of Teaching Experience of Teachers, Headmasters, and Education Officers who Completed Questionnaire II

<table>
<thead>
<tr>
<th></th>
<th>Professional Qualifications</th>
<th>Years Teaching Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Responses</td>
<td>Std.6 + PTL (T4)</td>
</tr>
<tr>
<td>Teachers</td>
<td>447</td>
<td>159</td>
</tr>
<tr>
<td>Headmasters</td>
<td>28</td>
<td>1</td>
</tr>
<tr>
<td>Supervisors</td>
<td>26</td>
<td>1</td>
</tr>
</tbody>
</table>

RJC = Rhodesian Junior Certificate (8 yrs.).

"O" level = Ordinary Level Certificate (11-12 yrs.).
**Primary Schools.** The schools are generally classed as "government" schools or "aided" schools. The former are government owned and maintained and under the authority of the Ministry of Education, while the latter are mission schools or under the authority of a committee, provincial authority, rural council, community board, or, more often, under an African council. However, government pays for the teachers and provides grants to help support the school as well as providing syllabuses and inspectorate. There are also 200 unaided schools. Table 15 shows some figures from the 1977 Annual Report of the Secretary for African Education.

These figures show that a large majority of the schools are those under the authority of the African Councils. What this means is that although government pays the teachers' salaries, the facilities of the schools, including the buildings themselves, will vary greatly depending on the support and prosperity of the African Council concerned. It also indicates that most of the schools are rural, as the councils are located in the Tribal Trust Areas. In fact, data obtained from the Ministry give a figure of roughly 90% of the African primary schools as being rural.

Physical facilities vary greatly, specially between urban and rural schools. There is electricity and running water in the urban schools but these are not available in the rural areas. However, all the rural schools have water (from a well or stream). All the government schools are in the urban or semi-urban areas. Generally these schools are well built and fairly well equipped. There are classrooms for all the classes. These are usually 7 m x 9 m and hold
Table 15. Number of Primary Schools, African Division, 1977

<table>
<thead>
<tr>
<th>Year</th>
<th>Government</th>
<th>Provincial Authority</th>
<th>African Council</th>
<th>Community Board</th>
<th>Mission</th>
<th>Rural Council</th>
<th>Committee</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>100</td>
<td>413</td>
<td>2,096</td>
<td>8</td>
<td>308</td>
<td>58</td>
<td>343</td>
<td>3,326</td>
</tr>
<tr>
<td>1976</td>
<td>95</td>
<td>320</td>
<td>1,970</td>
<td>8</td>
<td>490</td>
<td>55</td>
<td>337</td>
<td>3,275</td>
</tr>
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</table>
between 41 to 46 pupils. There are blackboards, cupboards, and basic classroom equipment such as chalk, pencils, exercise books, paper, and textbooks. The pupils sit in groups of 8 on benches around tables.

Below are the Ministry's essential minimum requirements in terms of exercise books and basic equipment as prescribed in the Teachers' Education Guide, No. 55:

<table>
<thead>
<tr>
<th>Grades</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tr>
<td>Exercise Books</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
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</tbody>
</table>

1. Pencils and/or pens (ball point) as required at various levels.
2. Rulers in Grade 2 and above.
3. Each school should have a radio in working order and a clock.
4. A small supply of rubbers (erasers) held by the teacher.
5. Physical Education equipment as prescribed in the P.E. tables.

The rural schools are definitely not as well-endowed. Aside from not having electricity and running water, the quality of the school buildings is generally poorer and there is a noticeable lack of materials and basic classroom equipment. Sometimes, the number of classes exceed the classrooms available. In none of the urban or rural schools visited by the team did we see a school library. These are very rare. However, in the government schools and in urban areas mainly, the teachers keep a small number of books available for pupils' use.

Pupils. There was a total of 855,025 pupils enrolled in Rhodesian African Primary Schools in 1977. Roughly, 90% of this figure represents the enrollment in rural schools.
A study by Kileff (1973) showed that from Grades 1 to 6, the rural primary school pupil achieves a lower academic performance than his rural counterpart. This is attributed possibly to his diet, greater distance from school, parents' attitude toward education, home duties, and his general social and physical environment. However, in Grade 7, the rural pupils performed better in the external Grade 7 examination. Twenty-five per cent of them achieved first division passes compared to 13% of the urban pupils. Kileff maintains that this might be due to greater motivation for the rural pupils (secondary education is seen as a way to higher incomes and new experiences) and less distractions while studying for the examinations.

The team's observations showed both urban and rural pupils to be highly interested in learning. However, there were more evidences of deprived home environments in the rural areas, such as the pupils more often being poorly and uncleanly dressed (not all wearing uniforms) and generally barefoot, showing signs of malnutrition and definitely not as proficient in English as their urban counterparts.

Generally, the rural pupils come from small "mushas" or villages. The family homestead consists of a few structures—usually a few living huts and one storage hut. Their parents are generally subsistence farmers. After school the children help with chores like tending cattle, weeding, looking after siblings, and fetching firewood and water.

The majority of urban pupils live in townships, high density living areas with western type houses. Tap water is available and often so is electricity. In this environment, cars, televisions, and
refrigerators are familiar. The main chores for pupils to do after school are looking after siblings and washing up.

**Community or Local Environment.** The community or local environment definitely is an important resource in terms of meeting the pupils' needs for environmental literacy. Not only does it provide a spectrum of learning experiences, but it is the reality with which pupils will have to come to terms in order to achieve happiness and fulfillment in life.

Important components in the environment of the rural child are the school, his "musha" or home, and the veld (with the growing of crops and herding of cattle). The council provides input into that scene in the form of the school, a clinic, a beerhall, a mill (for grinding maize), and stores and/or market near a bus stop. Usually the rural areas also receive the services of government workers—advisers on health, agriculture, forestry, and women's clubs. There are often advisers also for the Young Farmers' Clubs. These are all resources which may be utilized in one form or another by the school (i.e., source of reference material, speakers, demonstrators). Agricultural projects and wildlife parks which may be nearby are also good resources. Parker (1976, p. 23) provides a model of interaction between the African rural primary school pupil and his environment (Figure 5).

For the urban pupil living in a township, the important components in his local environment are the school, his home, the township, and the city or town. The services provided by the township
Figure 5. Model of Interaction Between African Rural Primary School Pupil and His Environment.
administration, such as clinics, shopping centers, recreational facilities, technical and craft centers, etc., are resources which can be tapped. The nearby town or city also provides certain other resources such as factories and industries, hospitals, research facilities, sewage treatment and water purification plants, museums, airport and railway and bus stations.

Applying Parker's model, the interaction between the African urban primary school pupil and his environment may be represented as in Figure 6.

**Agencies and Organizations.** Investigation of possible study areas and materials available through organizations and government departments concerned with environmental issues revealed these to be limited at present. Two schools, Mushandike and Tsanga, specially designed to provide outdoor education for a week or so to upper primary school pupils, were closed due to the war situation. Nevertheless, there are some organizations whose activities provide interesting field trips and which would be willing to provide visiting speakers to schools. The names, activities, and services available of twelve of these are listed earlier in this chapter.

**Media.** At present, radio lessons are being used as part of the regular English curriculum, and proving very successful. Also, a series of radio lessons accompanied by written material, on the workings of a camera, a car, a refrigerator, and similar items is being tested by A. Dock, a lecturer in the Science Education Centre, for possible use in distant teaching. Robson (1974) also successfully
Figure 6. Model of interaction Between African Urban Primary School Child and His Environment.
incorporated radio lessons as part of a primary science curriculum. Thus radio offers a valuable possible resource. A weekly radio program, "Teacher's Magazine," and a monthly journal, "Teachers' Forum," now provide useful communication links.

Resources Required

The determination of resources required was made largely on the basis of what is now available and on what might be a reasonable likelihood of obtaining increased resources.

As the country enters into majority rule, it is very possible that there will be a move toward compulsory primary school education. In which case, funds available for education will most likely be required to be spent in availing education to more pupils rather than in improving existing facilities.

Uppermost in the minds of the team were the available human resources (the teachers, pupils, and possible resource people from the community) and physical resources (the school facilities and equipment and the local environment). In the selection of the required resources for the Environmental Science course, special effort was made to utilize the available resources fully, optimally, and realistically and not go too far beyond these.

With this consideration, the selection of the resources needed for the lesson units was made on an individual lesson basis, focusing on how best to bring about effective learning conditions. Particularly in the early grades, special effort was made to give opportunity for more concrete experience, and the development of awareness
through the senses. Because of the fact that many of the children come from homes where the language is Shona, Ndebele, or Nyanja and not English, written resources do not feature prominently during the first grades as well.

An aid to media selection is provided by Dale's (1969) "Cone of Experience." He lists twelve categories of media and exercises, roughly age-related. For example at level 1, "Direct purposeful experience," pupils would learn by doing, using all their senses and physically coming into contact with objects, animals, etc. Below are Dale's categories:

12. Verbal symbols.
11. Visual symbols--signs; stick figures.
10. Radio and recordings.
8. Motion pictures.
7. Educational television.
5. Study trips.
4. Demonstrations.
3. Dramatized experiences--plays, puppets, role playing.
2. Contrived experiences--models, mock-ups, simulation.
1. Direct purposeful experience.

Two categories not considered for our purposes were 7 and 8, educational television and motion pictures, as these are not generally available nor likely to be in the near future.
A recommended rule for using these categories is "Go as low on the scale as you need to in order to ensure learning, but go as high as you can for the most efficient learning" (Gagne and Briggs, 1974, p. 151).

In selecting the desired kinds of material, media, or exercises, the first question asked was, "Are they available?" If not, the question was "Can they realistically be made available or developed?" If the answer to this question was negative or doubtful, then the lesson was modified.

Generally then, the course as designed was not expected to cause undue strain on present resources and so far, field trials of lesson units have indicated no problems in terms of resources required, so the choices seem appropriate. No special apparatus or equipment will need to be purchased. Nevertheless, the course does call for increased or improved resources as follows:

1. Time and money to be spent on in-service courses to train teachers in newer, more pupil-centered approaches and to re-orientate teachers, headmasters, and supervisors to more flexible forms of evaluation and less dependency on rigid work patterns and presentation.

2. More pictorial and reference materials in the classroom. This need might be met through community participation. For example, certain industries and organizations might be encouraged to provide reference materials to the schools on their activities.
3. Basic equipment to be available in each classroom as follows:
   blackboard and chalk; exercise books; pencils; old newspapers;
   glue; manila paper; colored pencils or crayons; scissors;
   string; and an assortment of empty tin cans, plastic, and
   glass bottles.

4. An area which can be used for gardening projects and experi-
   ments.

Constraints

An analysis of constraints in regards to cost effectiveness
was not carried out as this was not part of the team's assignment. As
this program will be integrating and replacing others in existence, it
is not likely that the program will fail because of the cost factor,
simply because the major part of the cost (teachers' salaries) are
already being borne. However, it would be a worthwhile exercise to
calculate the development and implementation costs involved and compare
it with other similar programs. It is the researcher's guess that
because it is being developed through existing channels in the Ministry
and the University with full and voluntary cooperation from many
sources, the cost so far has been incredibly low.

The largest constraints visualized in the program's implementa-
tion are (1) getting the teachers to present the material and manage
the pupils as envisaged by the team and (2) establishing close links
with all the participating schools. Both of these constraints are
aggravated by the current war situation which has placed over 70%
of the country under martial law.
Instructional Materials

Gagne and Briggs (1974, p. 223) maintain that, "It is not an overemphasis to say that materials can make or break the system as a whole."

In an overview of the curriculum development programs throughout the English speaking African countries, Hawes (1977, p. 163) found a "troubled history of high cost, lack of money and lack of priorities in the selection and distribution of materials." He maintained that some of the more depressing moments of his visits to African schools were "to find children sitting glum and bookless or to find no supplementary materials other than 30 or 40 identical texts per class." This last statement could well apply to some of the schools which the team visited here in Rhodesia. Lack of materials in the schools is definitely a major problem which the team encountered and which needs rectifying.

Present Policy

Although at present, the Ministry of Education makes provision for government schools and recommends for other schools that each pupil have his own textbook for the Grade 7 examined subjects (i.e., English, Mathematics, and African language), this does not apply for the subjects with which this study is concerned and which are being integrated into Environmental Science. Table 16 contains the Ministry's textbook recommendations for those subjects, and for dictionaries and atlases, as set out in the Teacher's Education Guide No. 55.
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<td>E</td>
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<td>E</td>
<td>ESG</td>
<td>E</td>
<td>ESC</td>
<td>E</td>
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Key: E = Essential, O = Optional, SG = Shared— one copy per group, SC = Shared— class set (one set of 46 books for use in individual classes).
Consultation with members of the Education Development Unit of the Ministry pointed to a priority of initially providing instructional materials for the teacher. At the present time it was not seen as realistic to plan for individual pupil textbooks.

Views of Teacher Trainers, Education Officers, Supervisors, and Headmasters

Five major liaison meetings were held in various parts of the country to seek representative views from educational administrators and teacher trainers. Among other things, their views on instructional materials were sought. A report of these meetings (Appendix I) summarizes these as follows. [Note: Symbols in brackets reflect degree of support by participants from all five meetings. (St.) = strong support; (P.) = partial support; (Ind.) = Individual view; (TCL's) = supported mainly by Training College Lecturers; (Ed.R's) = supported mainly by Ministry of Education representatives.]

1. A teacher's resource book is seen as imperative. (St.)
2. Money is the limiting factor in terms of a textbook for pupils, desirable as this might be. (P.)
3. Material should not be presented in a highly structured form. This is "doing everything" for the teachers, destroys initiative, soon gets out of date, promotes boredom. (St.) Especially (TCL's).
4. Material should be presented in a highly structured way so as to make older, more traditional teachers use new approaches. (P.) And some (Ed.R's).
5. Highly structured approach can lead to teacher going through the motions without knowing purpose. If on the other hand teacher had to design own lesson this would be avoided. (St.)

6. Format should be suggestive rather than prescriptive. (St.)

7. Instead of "lesson steps" use "suggested steps." (Ind.)

8. Material should include behavioral objectives. (St.)

9. Format should give resource material only. Let teacher develop own lesson plan entirely. (Ind.)

10. Format should give topic, objectives, references (resource information), and suggested alternative activities. (Ind.)

11. Format should give topic, sub-topic, purpose of lesson unit, knowledge to be acquired, skills to be acquired, resources. (Ind.)

12. Topic should be presented with a "model." Strong suggestion that teacher should vary this according to needs of class and environment. (P.)

13. Possibly have an unstructured scheme for enlightened teacher and structured one for weaker teachers. (Ind.)

14. Present "unit/topic" plans rather than "lesson" plans. (Ind.)

15. List a variety of activities for each lesson or topic including things that can be done in the classroom and outside the classroom. (St.)

16. Syllabus should be presented in spiral manner whereby simple concepts in early grades are returned to in higher grades and built upon. (Ind.)
17. The written material should not be too long or detailed. There is a limit to what teachers will read. (Ind.)

Some Instructional Materials Being Used in Other Countries

Some of the instructional materials used in primary science courses which are environmentally oriented or in environmental study courses in other countries were reviewed with the specific purpose of considering the design and presentation of the individual lessons in teachers' guide books. Some of these were:

1. African Primary Science Program materials—science units written specifically for the teacher in the form of teachers' guides (African Primary Science Program, 1971) and science readers developed and used in Nigeria, Sierra Leone, Kenya, Malawi, Ghana, Uganda, and Tanzania.

2. Three Phase Primary Science (New Guinea) materials—presentation of lessons, each on its own stiff card, with step-by-step instructions to teachers.

3. Schools Council Science 5/13 Project, Using the Environment—four volumes to help the teacher teach pupils how to investigate their environment.

4. Biological Sciences Curriculum Study, Me and My Environment—a special education program. (This was of interest because it was developed to guide teachers who were unfamiliar with that teaching approach and attempted to develop ideas with a minimum of reading and the use of functional rather than technical language.)
5. Minnesota Mathematics and Science Teaching Project materials—fifteen units specially designed for the very young pupils.


Instructional Materials Currently Being Used in the Schools

The instructional materials generally in use in Rhodesian primary schools consist primarily of teacher's guides and possibly a pupil's textbook (for some grades in Geography). A set of Atlas is shared, and so is a dictionary. Some posters are also supplied through Audio Visual Services.

As yet, there has been no formal evaluation of the materials used in the Geography course. However, views from teachers elicited in Questionnaire II and from interviews showed them to be generally happy with the teacher's guide and pupil texts available. Their main objection was to chapters which dealt with very far away places to which children could not relate.

An evaluation of the effectiveness of Discovery Science 3 Teachers' Guide was carried out by Gilbert (1975). The study involved
a sample of 150 teachers in the Manicaland Province. A four part test was designed and validated. Part 1 measured the teachers' recognition of main ideas to be taught for each topic. Part 2 assessed the teachers' ability to relate questions set in end-of-topic evaluation lessons to main ideas. Part 3 measured the teachers' recognition of the scientific point of each animal story given in the text, and Part 4 assessed the teachers' understanding of required teaching skills. The results of this evaluative study showed the guide to be very effective in two areas, understanding of teaching skills and recognition of scientific point of stories. The guide was found to be ineffective in terms of teachers' recognition of major ideas, and their association of evaluation items with major ideas.

An evaluation survey carried out by the Ministry of Education (Rhodesia, 1977) on the Grade 7, third term syllabus titled Health and Home is of particular interest, because that course is more along the lines of the Environmental Science course. It is pupil-centered, activity based, and its content is selected on an "education for living" basis. There is no specific text recommended for this course, but special teaching notes accompany a teacher's guide. The mimeographed teacher's guide presented the material under the following headings:

1. Knowledge to be Acquired--listed in point form.
2. Pupils' Learning Activities--described generally (not step by step) and offering a long list to choose from.
3. Sources--referred teachers to the Teaching Notes, Discovery Science texts, the Atlas, pamphlets such as on soil erosion put out by other Ministries.
The material for each unit was preceded by objectives for the pupil. This represents a new departure in materials construction in Rhodesia.

The evaluation results showed 80% of the teachers concerned being in favor of stating objectives; 72.9% of them indicated that the schemes were easy to follow and 71.9% indicated that the knowledge to be acquired was clearly stated. However only 65.9% felt that the learning activities were clear, and 62.8% could not understand how the resources recommended were linked to the learning activities. The worst deficiency was indicated as to the availability, or rather to the lack of availability, of resources. Only 22% of the teachers indicated that the resources called for were available.

Classroom Trials of Materials by Team

The teaching materials used by the team in the schools consisted of mimeographed units of lessons presented to the teacher in very structured, step by step form. Each lesson included the following: (1) purpose of lesson, (2) preparation (including a list of required materials), (3) lesson steps, and (4) behavioral objectives. In addition, a short evaluation exercise followed at the end of each unit.

The team provided the required materials, including exercise books, for the trial lessons which the team members taught. This was done so that initially a choice of the minimum appropriate aids was made irrespective of the individual school facilities. However, the possible availability of these was then checked for in the actual schools in each case, and the requirements were modified accordingly when necessary.
The exercise books were provided by the team so that after the unit was taught, these books could be brought back and the work produced by the pupils in each grade carefully analyzed. Keeping exercise books for each grade in which pupils from many schools wrote, enabled the team to get a good idea of the range of work possible within a given grade.

The reason for using a structured approach is that initially, the team was more interested in teaching the lessons exactly as conceived so as to be able to assess the effectiveness of the suggested approach, and to be able to compare impressions with the other team members and then afterwards with teachers.

Use of posters normally available to schools through the Ministry's Audio Visual Services was made occasionally, although even in those cases, instructions were provided for the teacher or pupils for making a similar one of their own. This was in consideration of many schools being very remote and not having easy accessibility to resource materials.

Any pictorial material required was incorporated into the mimeographed lesson units as simple line drawings which could be easily reproduced by the teacher on the blackboard.

Instructional Materials for the Environmental Science Course

As a result of our investigations, some decisions about the instructional materials were possible, and the following were recommended:

1. A combination Teacher's Guide-Resource Book for each grade which will include:
a. Resource information for the teacher for each major topic, e.g., Soil.

b. Units of lessons (each of roughly 3 to 6 lessons on a particular topic). Each unit will contain suggested content, approaches and activities, materials required, and evaluation. It will also specify behavioral objectives for the pupil. Within each unit, there will be some structured lesson plans to help those teachers who prefer or need this type of aid and to provide examples of the recommended approaches. There will also be activity options offered.

2. A pupil's resource booklet which will contain a combination of line and photograph pictures, games, instructions for model construction, exercises to develop perception, and the like. The purpose of this booklet is to provide stimuli for purposeful activity. Every pupil need not have one, it could be shared by a group.

3. A collection of class materials to be used to construct audio visual aids as required. These should include: old newspapers; scissors; glue (or flour); colored pencils or paints; manila paper; empty tins, glass jars, and packets or bags.

Discussion

Gathering information regarding instructional materials from different sources and through different approaches is seen as a valuable procedure to determine decisions about materials for a new
course. The literature supplies a variety of ideas from which choices can be made. Teacher trainers and administrators' views are imperative in terms of making valid decisions about instructional materials in the context of the whole educational system. Input from teachers provide the wisdom of experience. Evaluation of existing materials allows weaknesses and strengths to be spotted and helps to prevent unnecessary mistakes. Finally, the actual trials in the schools allow the curriculum developer to assess whether the teacher-learning strategy is actually being communicated to the teachers through the materials and put into practice.

**Pupil Assessment**

Learning involves the acquisition by the learner of various capabilities—intellectual skills, information, cognitive strategies, motor skills, and attitudes—and manifests itself through modified behavior (Gagne and Briggs, 1974, p. 3). Thus it follows that the outcomes of instruction will consist of pupil performances which show the kinds of capabilities being acquired. The degree to which these are acquired is a measure of the effectiveness of the instructional design.

**Procedures from the Literature**

The literature offers many suggestions for pupil assessment. Some of the more commonly used procedures are:

1. Objective-referenced assessment—measures directly the human performances described in the objectives for the course.
2. Norm-referenced assessment—utilizes tests designed to yield scores which compare each pupil's performance with that of a group, or with a norm established by group scores.

3. Standardized tests—generally norm-referenced tests which have been given to large samples of pupils in specified age (or grade) groups, and the resulting distributions of scores obtained become standards against which an individual pupil's score is compared.

4. Mastery-referenced assessment—this is not only an assessment procedure but rather an instructional approach as well. The pupil is expected to achieve mastery (and here criteria indicating "mastery" must be specified) of possibly 90% of the objectives. It requires individual diagnosis and resolution of learning problems through the allocation of more or less time or different media or materials so that mastery is achieved.

5. Teacher-made tests—these may be objective or subjective, and sometimes are norm-referenced. They are usually designed to see how well a pupil has learned the content of a course. This means testing for various skills and knowledges at the same time.

6. Work and/or participation assessment—involving teacher judgment of the quality of work produced by a pupil, or of his participation in class activities. These are more indirect forms of pupil assessment.
Methods Currently in Use in Rhodesian Primary Schools

It appears that most schools require their teachers to submit monthly marks (grades) in the various subjects for each pupil. Paper and pencil tests are generally used for this purpose and stress recall of facts. During school visits, the team frequently saw "fill in the blank" testing being used. The teacher would write a passage on the blackboard, leaving out important missing words. The pupil would copy the passage, inserting the correct words.

The Grade 7 examinations which are given in the subjects of English, Mathematics, and an African language (either Shona or Ndebele) are norm-referenced tests. A pupil's performance is compared to the performance of all the pupils in Rhodesia taking the examination. A standardized aptitude test, specially designed for Rhodesian African primary pupils, is also administered to all Grade 7 pupils, and the results used to predict performance at secondary level.

Some Evaluation Exercises Used in School Trials

In the development of the lesson units, the team made a practice of including a short evaluation exercise at the end. So as to not depart too drastically from the accepted practice of paper and pencil tests, most of these exercises were just that, but there was a definite effort made to move away from just straight recall of facts. Below are examples of these exercises.
1. Evaluation exercise on Unit on Soil Formation and Soil Erosion, Grade 5. The object here was to test understanding in relation to a practical application of the learning:

Instructions to pupil: listen to this story:

Two brothers, Josiah and Edson, were having a big argument. They were trying to decide where to plant the maize crop for the family. This is what Josiah said—

"We should plant our seeds on the slope of the hill. The soil pieces there are bigger. They are washed clean by rain and all the dirty little pieces are washed down the hill. There are lots of small rocks on the hill and these will quickly make new soil. We do not need to do anything to the hill, just plough and plant the seeds. The maize plants will grow very well."

This is what Edson says—

"We should plant our maize seeds on flat land, not on the hill. The maize plants will grow better on flat land. It is more difficult to grow good crops on the slope of a hill. The soil there is not very good."

I hope you agree with Edson! But it was no use just telling Josiah that he was wrong.

In the end Edson wrote down on paper the reasons why he thought Josiah was wrong. He tried to teach him and explain why the soil on the hill was not very good and why it would be difficult to grow good maize there.

What do you think Edson wrote?

Answer this on a piece of paper. The heading should be:

"Edson explains to Josiah why he is wrong"

Some examples of responses are presented in Appendix J, Figures J.1 and J.2.

2. Evaluation exercise on Unit on Rubbish, Grade 3. The object here was to use drawings for assessment, and to allow the pupils to
express their understanding freely. Also, it was an attempt to assess attitude toward rubbish.

Instructions to teacher:

Ask each pupil to draw a picture to show something about rubbish. Then ask the pupils to complete the following which you write on the chalkboard. They may answer with words or with pictures. (Let them answer freely without guidance from you.)

When rubbish is lying around me, I see ______ (what?)
I smell ______ (what?)
I feel ______ (how?)

Some examples of responses are presented in Appendix J, Figures J.3, J.4, and J.5.

3. Evaluation exercise on Unit on Trees, Grade 4. The object here was to look for (a) the acquisition of information, (b) the ability of the pupil to expand his view of the environment, and (c) his predisposition toward constructive action.

Instructions to pupil:

(i) Give the names of three trees that are found around your school or home area. You may write the names in Shona, Ndebele, or English.

(ii) We know that people use trees for many reasons, but animals and birds also need trees. Mention four ways in which animals and birds use trees.

(iii) If there was a Young Farmers' Club in your school, describe how you would start a project to save trees.

Appendix J, Figures J.6, J.7, and J.8 show a few responses.

4. Evaluation exercise on Unit on Water, Grade 3. The object was to see whether the pupil had learned some properties and uses of water.
Instructions to pupil:

(i) Write down three things about water that you can see, feel, or taste.

(ii) Draw a picture of a person who is using water.

(iii) Write words on your picture to explain how the water is being used.

Appendix J, Figures J.9 and J.10 show examples of responses.

5. Evaluation exercise on Unit on Plant Roots Need Soil, Grade 5.

This evaluation exercise was aimed at assessing the pupil's understanding of the inter-relationship between soil and roots without too much need of formal expression.

Instructions to teacher:

Write this on the board:

ROOTS NEED SOIL

Instruct pupils to draw a picture to show how the roots of a grass plant spread through soil and to write as many labels as he can to explain what soil is like and how roots use soil.


The examples just mentioned were presented for interest's sake. They were not intended to be representative of any level of achievement.

The various different types of teacher (team)-made tests provided an opportunity to see some of the problems encountered in pupil assessment in the classroom.

Some observations made were:

1. Language difficulties often cause comprehension problems when open-ended questions are used in pupil testing. Formulation of lengthy responses is very difficult for this reason, too.
2. An inordinate amount of time appears to be required for pupils to answer questions in complete sentences. Writing is generally slow, especially at the lower grades.

3. Pupils appear to enjoy drawing pictures and expressing ideas through these.

4. The large pupil-teacher ratio precludes individual testing, and makes large demands on paper-marking time.

5. Up to now there appears to be much emphasis on uniformity of responses required from the pupils. Evaluation papers mailed back from school trials showed the same style of presentation, the same decorative border in some cases, and even the same picture in cases where individual drawings had been requested.

Initial Ideas on Pupil Assessment for the Environmental Science Course

As a result of the team's pupil-assessment experiences in the classroom, and from teacher trials, certain initial suggestions were made:

1. Different forms of communication, e.g., flow diagrams, talking, drawings, tables, other than pure writing, should be tried out to assess pupil performance.

2. Pupil assessment should be very frequent so as to enable early diagnosis of learning difficulties.

3. Pupil assessment should be designed so as to not make very heavy demands on the teacher's time.
4. Attempts should be made to move away from pupil uniformity of responses toward encouraging pupils to greater individual expression.

5. Since the course has planned objectives to be achieved, objective-referenced tests (with perhaps specified mastery criteria) seem appropriate. Some of the purposes which this type of test serves are given by Gagne and Briggs (1974, p. 179) as follows:

   They show whether each student has mastered an objective, and hence may go on to study for another objective.

   They permit early detection and diagnosis of failure to learn, thus helping to identify the remedial study needed.

   They provide data for making improvements in the instruction itself.

   They are "fair" evaluations in that they measure performance on the objective that was given to the student as an indication of what he was supposed to learn. This kind of testing is consistent with the honesty of the relation of teacher to learner.

Another important advantage of such tests is their ease of construction. By just changing a few words of the behavioral objectives, test items are produced. This is a big advantage in cases such as this one where a large proportion of the teaching force still has minimum training.

Initial Field Trials of Lesson Units

Each unit of lessons was initially created by an individual team member (sometimes with the aid of resource persons). The first presentation of the material then, was to the other two team members.
After some modification as a result of consultation, the unit was taught in the classroom following the same written guidelines, by all three team members. Occasionally the team members watched one another teach and at other times they would observe the actual classroom teacher trying out some of the material.

The questions that needed answering, to an initial degree, during these exercises were:

1. Can the unit achieve its purpose?
2. How can we tell the pupil is learning?
3. How can we best communicate the envisaged teaching-learning strategy to the teacher?
4. Do the available school facilities lend themselves to the approach?
5. What predisposing characteristics in the pupil or the teacher aid or hinder learning in this way?

After further consultation and revision, the material for the unit was mimeographed in a structured teacher's guide form (including necessary resource material) and then sent out by mail for trials in both rural and urban schools. Each draft unit went to about 15 schools. A questionnaire to be completed by the participating teacher followed each unit (see Appendix K). Data were obtained regarding the following:

1. Time taken by teacher to teach each lesson.
2. Interest displayed by pupils.
3. Availability of required aids or other materials.
4. Difficulty of the lessons for the pupils.
5. Vocabulary level.
6. Clarity of instructions to teachers.
7. Relevance of materials to pupils' lives.
8. Teacher's rating of the lessons and suggested revisions.
9. Achievement of the stated behavioral objectives.

Information from the completed questionnaires was compiled, and thus a good picture of teachers' views and experiences for each new unit was obtained. This information provided a basis for further modification of the units before publication of the materials.

Reactions from the teachers and from the pupils (as perceived by the teachers) were generally very favorable. The most common error concerned time allocation for the units. Generally the teachers needed at least an extra period, and often, a longer period of time to teach the unit as designed, but there were great variations among the teachers themselves. This pointed to the need for greater time flexibility, and eventually to the decision to use the lesson units as a core program, allowing extra time for teachers to expand on the units or plan their own activities.

Roughly two-thirds of the units were rated as being worthwhile as presented, while one-third of them were rated as of value with some revision. None of the units were found to be not worthwhile.

Often the revisions which teachers suggested had to do with the choice of words, emphasizing the need for clear, simple, familiar communication. This fact was borne out when it was realized that
question 11 of the teacher questionnaire (Appendix K) was being misunderstood by some of the teachers. In rating the lessons, the teacher was asked whether he felt that revision was needed, and if so, what did he suggest. Some teachers thought they were being asked whether revision (review) of the unit by the pupils was necessary, and therefore suggested pupil review exercises.

Another important suggestion that was frequently made was to take into account that, not having taken environmental education courses themselves, many teachers often did not have the necessary background for this new material. This finding led to the decision to provide background information for the teacher in each unit.

Year of the Child Project

Another method used in initial evaluation of the new material was through participation in a Year of the Child Project. In cooperation with the Environmental Social Studies Working Party and with Ministry of Health information officers, the team worked on a special project entitled "A Happy Healthy Me," which was designed for two purposes: (1) to commemorate the United Nations' Year of the Child and (2) to provide some feedback about teachers' opinions and reactions to the methods and materials for the new environmental studies program. A short, activity-based, child-centered "mini curriculum" on health and hygiene, which incorporated some of the material of the lesson units, was prepared at three levels (Grades 1-2, Grades 3-4, and Grades 5-6). The program was designed to fit into the normal school routine, and to be carried out during the 2nd school term of
1979. It was disseminated through the free teacher's magazine, Teachers' Forum, in the January, February, and March issues, and received radio support. An evaluation form was included to be completed by participating teachers and returned to the Science Education Centre. At the time of the writing of this report, the results had not been obtained yet.
CHAPTER 5

DEVELOPMENT OF ONE LESSON UNIT TOPIC--WILDLIFE

In this chapter, the development of one unit is presented to illustrate the kinds of thinking and activities which went into the development of each unit.

Planning

Each topic that was selected as the subject for a unit of lessons was seen within the context of the framework illustrated in Figure 7.

The topic "Wildlife" was originally brought to the team's attention at a symposium held at Wankie National Park to commemorate its 50th Anniversary in August, 1978. At that time, experts in various aspects of Wildlife Ecology and Management and government representatives pointed out the great need to conserve wildlife not only as a valuable heritage, but for the improvement in the productivity of the land itself. The need for all people, not only tourists, to benefit from national parks, was pointed out, and by the end of the symposium there was a general consensus of the need to launch a vigorous educational campaign, at all levels, to promote better attitudes toward wildlife and its preservation.

Thus, in selecting wildlife as the topic for a unit, it was seen from the following aspects:
Figure 7. Aspects to Consider in the Selection of Content and Strategies in the Development of Lesson Units
1. National Needs—this is a high priority as borne out by experts, government officials, and from constant media attention (Saunders, 1977).

2. Home and Community—wildlife figures prominently in Shona traditions. For example, every Shona family has a totem, which is the name of an animal. People having the same totem are not allowed to marry (Gelfand, 1973). Also, traditions have governed hunting which is seen as an inherent right. Generally "mukha we dsango" (wildlife) has been regarded primarily as food. At present, however, relatively few Shona children have ever seen large wild animals or visited a game park.

3. Teacher—wildlife was selected as fourth in priority in the questionnaires which were completed by teachers, thus indicating that a unit of lessons on this topic would be welcomed by them. Since teachers themselves have received virtually no wildlife education as such, it was felt that in-service training would have to provide this experience, and a unit of lessons on wildlife would have to be self-explanatory.

4. Schools—these present a challenge, as most do not have the audio visual materials and books which would be an asset to wildlife studies. Nevertheless, most primary schools are in rural areas where first hand observation of some types of wildlife might be possible. Also, the Parks and Wildlife collective estate comprises approximately 10% of the country and consists of 11 national parks, 28 botanical reserves and gardens, 15 safari areas, 4 sanctuaries, and 9 recreational
parks (Saunders, 1977, p. 190). If arrangements are made, these could be utilized by nearby schools.

5. Pupil Preparation for After School—in view of the present struggle for self determination, the present primary school children will very likely be among the first generations to chart new development policies in this country. It appears imperative that the development of positive attitudes toward wildlife be promoted now, specially since for the majority of them, primary education will most likely be terminal. For those going into secondary education, wildlife study can also serve as a means of learning skills such as observation, measuring, and communication in preparation for further study.

6. Learning Capabilities (Intellectual Skills, Cognitive Strategies, Information, Attitudes, Motor Skills)—it was important to classify the desired performance objectives of a unit on wildlife in order to facilitate a review of the adequacy of the objectives, the determination of the sequencing of instruction, and the planning for the required conditions of learning (Gagne and Briggs, 1974). Thus it was seen necessary to design instruction to provide: (a) information on wildlife; (b) opportunities for concept development; (c) practice of skills such as drawing, measuring, and speaking; (d) a forum for the exchange of ideas and the modification of attitudes; and (e) opportunity to learn to use pictorial resource materials in the absence of living animals.
John Makina, assistant interpretive officer from the National Parks and Wildlife Department, was invited to join the team as a resource person in the development of this unit. His help was invaluable as he could provide information about wildlife and existing problems in its conservation, about the operation of national parks and what materials (e.g., maps, pictures) and other forms of cooperation might be available to schools from them, and finally, about the traditional beliefs concerning wildlife and real life experiences of rangers and visitors to national parks.

Figure 8 shows some of the thinking in designing the unit.

**The Lesson Unit**

In accordance with the philosophy of the whole course, the unit was to be largely problem-centered and activity-based. Initially, three blocks of time were set aside for three "lessons" or main activities.

Table 17 lists the purposes of the lessons, the pupil behavioral objectives sought, and the planned activities to achieve these.

The attitudinal objective for the whole unit was to help develop positive attitudes toward national parks and wildlife. The level of skills to be used was selected within the context of the whole seven year program, and for preparation for further study. Following is a list of skills to be emphasized in this unit: (1) constructing and interpreting maps (use of symbols and scale); (2) using mathematics (estimating size, calculating mass, measuring); (3) communicating (listening, discussing, reporting); (4) recording (drawing, writing, making tables); (5) role-playing; and (6) problem solving.
PROBLEM

Can pupils (urban & rural), remote from wildlife, get a feeling of wild animals and their surroundings? Can they identify with them, understand, enjoy, and be stimulated by this topic?

try for pupil to identify with animals and with their surroundings

APPROACH

Go back in time. Assume animal personality.

Some understanding of habitat—food, behavior, territory. (Opportunity for using mathematics, mapping, etc.)

APPROACH

Use man as the threat in man/animal conflict. (Opportunity for traditional story-telling technique.)

Solution

TERMINAL OBJECTIVES

Positive attitudes toward wildlife heritage and national parks:
- Appreciation of interdependence
- Information on wildlife
- Mapping skill development

Figure 8. Stages in the Development of a Unit on Wildlife
Table 17. Purposes, Activities, and Behavioral Objectives of Lessons in Unit on Wildlife, Grades 5/6

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Purpose</th>
<th>Main Activity</th>
<th>Behavioral Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Idea of present surroundings being different 100 years ago.</td>
<td>Outdoor walk.</td>
<td>Pupil will be able to: describe possible changes in the surroundings 100 years ago.</td>
</tr>
<tr>
<td></td>
<td>Some characteristics of different wild animals.</td>
<td>Group work interpreting pictorial resource material.</td>
<td>Obtain answers to questions from pictorial resource materials about some wild animals.</td>
</tr>
<tr>
<td>2</td>
<td>Different animals eat different things.</td>
<td>Application of pictorial resource material information.</td>
<td>Place animals in groups according to food they eat.</td>
</tr>
<tr>
<td></td>
<td>Making and interpreting maps.</td>
<td>After teacher demonstration, pupils make own maps of animal trails.</td>
<td>Construct maps using symbols, use scale to indicate distance, and read others' maps.</td>
</tr>
<tr>
<td>3</td>
<td>Solving the problem of man and wildlife coexisting and benefiting from one another.</td>
<td>Story telling to pose problem, discussion to find possible solutions, and reporting.</td>
<td>Make sounds or mimic characteristics of at least one wild animal. Offer at least one solution as to how man and wildlife can coexist. Give at least 2 arguments from the animals' viewpoint and 2 from man's viewpoint as to why national parks are a good idea.</td>
</tr>
</tbody>
</table>
Formative Evaluation of the Unit

Once the unit had been conceived, it was imperative to find out if indeed it worked in the actual classroom situation. The main methods of initial formative evaluation which were employed for every lesson unit were: (1) examination, discussion, and modification of unit by the whole team; (2) trial teaching by the team members, and after further modifications and improvements; (3) trial teaching by teachers in the schools. In the case of this unit, an extra video taping exercise was included.

Video Tape Exercise

The initial trial teaching by team members was video taped, one lesson in each of the three classes during three consecutive days, thus recording the whole unit. The purpose of this exercise was to make a record of the unit which could be (1) reviewed for an assessment of the approaches, teaching techniques, facilities, and pupil reaction, and (2) used by curriculum classes at the University of Rhodesia and teacher-training colleges. A third value, not originally anticipated, was that it provided feedback from the pupils themselves when they were shown the video tapes of the lessons.

Constraints

As a result of the trial teaching and video tape assessment, certain constraints were identified:

1. Concept of time--this was not found to be well developed, and pupils found difficulty coping with the idea of "100 years."
2. Use of scale--this presented some difficulty. Often the distances indicated were grossly unrealistic. This indicated the need for more practice in using scale techniques and for the provision of more information regarding animal movement and behavior.

3. Limitations of materials--despite the fact that the school chosen for the teaching trials was much more endowed than the average primary school, only one used coloring book containing animal pictures was available in one of the three classes. The availability of large pieces of paper for map drawing could be a problem.

4. Numerical ability--lack of confidence was evident by examination of the pupils' work and of the evaluation exercise. Consistently, in labeling their own work, figures and estimates of weight and height were either left out altogether or were often incorrect.

5. Communicating in a second language--difficulty in this area was encountered. On numerous occasions, pupils were motivated enough to raise their hands to answer a question or speak, but when called upon, remained "tongue-tied" and silent. Also, during the working sessions, pupils often spoke in Shona to one another.

6. Social customs--within each of the groups, the tendency for girls to speak only to girls and for boys to speak to boys was quite noticeable.
Set patterns of work—this proved to be a constraint at three different points in the unit:

(a) Despite the type of recording that they were doing, the pupils tended to cram their writing so as to utilize every bit of space in their notebook, as they have been taught to do. In making a table, this often caused data to be recorded inaccurately.

(b) Although pupils were given freedom to make up their own groups for this unit, they tended to remain in their normal assigned groups (where ability is the criterion).

(c) In acquainting them with a new technique, "hook ups" (illustrated in lesson 3 of this unit in Appendix L), instead of drawing free-hand lines and circles, the pupils took an inordinate amount of time using rulers and drawing straight lines and rectangular boxes for the sake of neatness.

Time—the time allocated to each of the three main activities proved to be too short in order to adequately achieve the desired objectives.

Picture perception—this appears to be an area where much attention is needed. The pictorial resource material which was provided was, of necessity, quite simple, and purposefully contained combinations of line drawings, pictures, and representations of various sizes (see Appendix L). There were quite a few misperceptions, particularly to the representation of size. For example, in answering the question on the rhinocerus
resource sheet, "What do you (a rhinocerus) do when you are angry?" a pupil said, "I get very small and wrinkled." This was because the charging rhinocerus in the resource sheet is indeed smaller and more shaded than the feeding rhinocerus.

After these constraints were identified, efforts were made to remove them. In this endeavor, the literature often provided some useful aids.

Communicating in a Second Language

In this area, the literature does not provide definite answers, and there appears to be need for more research into this unique situation where children are taught a second language for it to become the medium of instruction. The Hole Committee of 1908 (Atkinson, 1972), and later the Judges Commission Report (Rhodesia, 1963, pp. 46-48), recommended English right from the start as a vehicle for instruction in Rhodesia. Partridge (1963) was also an enthusiast for English from Grade 1, and Lanham (1973) advocated first an oral-aural phase as a stage to reading and writing skills. Since English as a vehicle for instruction is the present policy, useful to this study is work such as that of Strevens (1976). He clarified the kinds of language problems encountered by science educators and learners of science when the vehicle of instruction is not their mother tongue, and stressed the importance of cooperation between English and science teachers.

On the other hand, Hofman (1974, p. 42) recommended that "a research effort of some magnitude should be devoted to a re-examination of the policy of beginning both English and vernacular speaking,
listening, reading and writing from the start of the primary school."
Also experts on environmental education in Africa have recommended to
UNESCO that environmental education should be taught in the indigenous
language (UNESCO, 1976). As they have also maintained that environ­
mental education should be interdisciplinary and, at present, the
majority of schools are being taught in English or French, this is
somewhat contradictory.

Number Concept Development

Hendricks (1966) of the University of Rhodesia conducted
studies on number concept and level of number development in pre­
school Shona and European children. Her findings point to the need
for "enrichment" of children's experiences. "It seems certain that
cultural environmental opportunities are important in the development
of intellectual skills" (Hendricks, 1966, p. 208).

Picture Perception

In the area of picture perception, Leslie Leach of the
University of Rhodesia has conducted research for a number of years.
Using variations of Jahoda and McGurk's instruments for testing
pictorial depth perception and Hudson's pictorial space comprehension
 technique, Leach (1977c) has provided evidence to show that training
in pictorial depth perception increases both pictorial depth interpreta­
tion and pictorial space comprehension, to a lesser degree. Also he has
shown that seemingly, young children are assisted to interpret depth in
pictures by numerous cues (Leach, 1977b). Although originally, he felt
pictorial perception to be age-related (Leach, 1977a), further research
and re-analysis of his data has shown that it is more likely to be experience related (Leach, 1978).

Action to Remove Constraints

Table 18 which follows, shows the constraints that were identified in the initial trials of this unit, and the measures taken to remove them.

After initial revision, the unit was rewritten and mimeographed for distribution. A Teacher's Questionnaire was designed to accompany it. After the pictorial resource material is reproduced, the unit, teacher's questionnaire, and resource materials will be mailed out to at least 15 different schools for field trials. Following this, further revision, as recommended by the teachers, will be made.

Copies of the revised unit of trial lessons, teacher's questionnaire, and an example of the pictorial resource material are found in Appendix L.
Table 18. Constraints Identified at First Trials of Wildlife Unit and Action Taken to Remove Them

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Action to Remove Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept of time not fully grasped</td>
<td>Provided aids (e.g., clues).</td>
</tr>
<tr>
<td>Difficulty in estimating distance</td>
<td>Provided more information on animal movement and behavior, and more practice using scaling techniques.</td>
</tr>
<tr>
<td>Limitation of materials</td>
<td>Provided all basic resource material needed for the unit. Included manila paper (large sheets) in basic equipment list.</td>
</tr>
<tr>
<td>Lack of confidence in numerical ability</td>
<td>Checked mathematics syllabus to ensure that prerequisite skills have been taught. This being the case, made provision for more practice.</td>
</tr>
<tr>
<td>Difficulty communicating in a second language</td>
<td>Encouraged communication in Shona as required, and provided more opportunity for pupil expression in English, and through drawings.</td>
</tr>
<tr>
<td>Tendency for girl-to-girl, and boy-to-boy communication</td>
<td>Since this is largely an accepted traditional more, no action was taken to remove it.</td>
</tr>
<tr>
<td>Set patterns of work</td>
<td>Acknowledged need to conserve paper, but emphasis must be on accurate, meaningful, and varied ways of recording. Also, provided for more varied grouping.</td>
</tr>
<tr>
<td>Lessons were too long</td>
<td>Extended the original three lessons in the unit to six,</td>
</tr>
<tr>
<td>Difficulties in picture perception</td>
<td>Conducted literature research, and consequently provided more exposure to pictorial material by rotating the resource sheets among the groups. Also decided to provide more pictorial material at earlier grades.</td>
</tr>
</tbody>
</table>
CHAPTER 6

THE CURRICULUM PLAN

The production and initial immediate trials of complete lesson units at different grade levels and on different subjects was a crucial step in this stage of the project. This allowed early assessment of the proposed topics, teaching techniques, and materials. Much valuable information was gained, in addition, about the sequencing and pacing (allocation of time) for the units. It enabled more realistic planning of future ones.

The major subject areas of the curriculum, which had generally been defined as a result of the questionnaires and interviews in the early part of the study, were then delineated, and a spiral approach (returning to each subject area every year) was adopted. This approach was seen to have merit as it allows more time for the development of attitudes and values, and for the acquisition of information regarding certain vital areas (e.g., health, natural resources) important to the improvement of the quality of life. It also provided more opportunity for review and for pupils, who may have missed something at one grade, to be able to pick it up at the next.

The next step then, was to consolidate all the research information and team experiences in the development of a complete framework of the curriculum plan for Grades 1-7. To do this, large boards were set up, one for each grade, to contain the suggested year's work scheme.
The three team members chose the topics each member would work on. Taking one topic at a time (e.g., water) the team member concerned would define the terminal objectives for the seven years and then work out a scheme for grades 1 through 7, separately listing the content, concepts, skills, attitudes, and finally behavioral objectives to be achieved at each grade level. In the course of this exercise there was consultation as required with other team members, resource persons or materials, and teachers. The syllabuses for mathematics and for English (Grades 1-7) were used to provide for learning reinforcement across the curriculum and to plan for realistic mathematics skills and language requirements in the units. Figure 9 illustrates the layout of part of a board for Grade 3.

<table>
<thead>
<tr>
<th>Natural Resources</th>
<th>Grade 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Content</td>
</tr>
<tr>
<td>Water</td>
<td></td>
</tr>
<tr>
<td>Soil</td>
<td></td>
</tr>
<tr>
<td>Trees</td>
<td></td>
</tr>
<tr>
<td>etc.</td>
<td></td>
</tr>
</tbody>
</table>

B.O.s = Behavioral objectives

Figure 9. Illustration of Physical Layout Used to Compile the Curriculum Plan for Each Grade
As each topic was developed, the data were compiled on the boards. When this was completed, the whole team reviewed, modified, and approved the development of each topic area across the grades and then as outlined for each year's work.

This part of the project took up the better part of three months to accomplish. The physical procedure is described here because it was found to be very satisfactory. The large layout allowed the members of the team to look and work on the plan at the same time, allowing coordination of efforts. It was also easy to retrieve information, make corrections, and to see, at a glance, what needed doing. Resource persons and other interested parties, such as members of the Environmental Education Committee, could easily see what was being accomplished, and talk about their ideas in relation to it.

When the whole compilation was completed, the first provisional scheme of the curriculum plan was typed up. It was presented to the Environmental Education Committee and to the Environmental Social Studies Working Party. During working sessions of the two working parties combined, overlapping areas were discussed and sorted out so that there would be no duplication of the materials to be produced.

Figure 10 is a pictorial representation of the curriculum plan. It shows the major subject areas and topics under each one. It also depicts the spiral approach, and the child at the "center" of the curriculum. Table 19 sets out the main content areas, approaches, underlying concepts, and skills.
Figure 10. Pictorial Representation of the Curriculum Plan's Content and Spiral Approach to Represent Grades.
Presentation of the Curriculum Plan's Content and Spiral Approach — The numbers 1-7
Table 19. Main Content Areas, Approaches, Underlying Concepts, and Skills of the Curriculum Plan

<table>
<thead>
<tr>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Resources:</td>
</tr>
<tr>
<td>1. Soil</td>
</tr>
<tr>
<td>2. Grass</td>
</tr>
<tr>
<td>3. Trees</td>
</tr>
<tr>
<td>4. Water</td>
</tr>
<tr>
<td>5. Plants &amp; animals</td>
</tr>
<tr>
<td>6. Fuel &amp; energy</td>
</tr>
<tr>
<td>7. People</td>
</tr>
<tr>
<td>8. Decaying matter</td>
</tr>
<tr>
<td>9. A balanced world</td>
</tr>
<tr>
<td>Agriculture:</td>
</tr>
<tr>
<td>10. Plants &amp; animals</td>
</tr>
<tr>
<td>11. Land treatment</td>
</tr>
<tr>
<td>Physical Environment: Natural:</td>
</tr>
<tr>
<td>12. Sun &amp; cosmos</td>
</tr>
<tr>
<td>13. Weather</td>
</tr>
<tr>
<td>14. Land forms &amp; minerals</td>
</tr>
<tr>
<td>Physical Environment: Man Made:</td>
</tr>
<tr>
<td>15. Tools &amp; machines</td>
</tr>
<tr>
<td>16. Materials we use</td>
</tr>
<tr>
<td>17. Infrastructure</td>
</tr>
<tr>
<td>18. Pollution</td>
</tr>
<tr>
<td>19. Health &amp; Hygiene</td>
</tr>
<tr>
<td>20. Body Systems</td>
</tr>
</tbody>
</table>

Approach

Aim should be to:
- Use local environment.
- Stress underlying concepts, use content as a means of achieving understanding of concepts, not as an end in itself.
- Integrate subject material wherever possible to bring out inter-relationships. Avoid topic isolation.
- Incorporate freely, mathematics, language, art, and drama.
- Strive for relevance at all times.
- Aim for pupil centered learning: Maximum observing, telling, finding out, asking, applying skills.
Table 19.—Continued Main Content Areas, Approaches, Underlying Concepts, and Skills of the Curriculum Plan

- Aim to move away from teacher dominated instruction: minimum of passive listening, copying, answering.
- Provide for flexibility: intersperse structured core blocks with unstructured blocks which teacher plans and can use to pursue particular interests, projects, or suggested options.
- Promote pupil creativity & expression; e.g., individual log books for recording independent observations & happenings in environment.
- Foster awareness at all times, progress to identifying problems & where feasible to suggesting solutions.
- Simplify, refrain from sophistication, complex apparatus, language & secondary school content.
- Resolve scientific phenomena & principles to clear basic ideas.
- Encourage communication between pupils.
- Link classroom learning to development & problems in local environment.
- Use a variety of methods for recording information & observations.
- Create an atmosphere of vitality, tolerance & fun.

### Concepts Underlying Content

| mass       | matter       |
| volume    | properties   |
| growth    | changes      |
| measurement | natural resources |
| energy    | cycles       |
| conservation | decay        |
| inter-dependence | body systems |
| inter-relationships | systems     |
| cause & effect | input & output |
| scale     | color        |
| time      | prediction   |
| fuel      | temperature  |
| heat      | distance     |
| speed     | direction    |
| numbers   | production   |

### Skills

For pupils to gain experience in:

- measuring
- observing
- classifying & sorting
- recording
- role playing
- simplifying
- manipulating
- problem solving
<table>
<thead>
<tr>
<th>Collecting</th>
<th>Describing</th>
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<tr>
<td>Experimenting</td>
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<td>Investigating</td>
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<td>Communicating</td>
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<td>Questioning</td>
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Draft Core Syllabus

An abstract of the first draft of the curriculum plan was made to produce a draft core syllabus. It was presented as it appears in Table 20 with the following introductory points:

1. The attached scheme puts forward ideas as to what pupils will have encountered in Environmental Science by the end of seven years primary schooling.

2. The course is concept based and pupil centered. The environment will serve as a topic umbrella under which basic concepts, skills, and attitudes will be developed.

3. The language used in setting out these ideas in no way reflects the style or simplicity envisaged in actually teaching the material. Inherent in the approach will be the resolution of sophisticated principles and phenomena into clear basic ideas and the presentation of these in language and manner suitable to pupils.

4. Flexibility: It is intended to introduce options within the core syllabus. In addition, flexible units are proposed in which teachers will plan their own activities, pursue interests, and undertake projects related to the main core syllabus. Such a scheme could also allow for the development and maintenance of school gardens in areas where these feature as important and vital to the life of the school. However, gardening "science" and aligned activities will be incorporated into the core syllabus itself.

5. Medium of instruction will be English, but particularly in the first three grades the teacher will be encouraged to use the home language when necessary to ensure good communication.
### Table 2Q. Draft Core Syllabus, Environmental Science

<table>
<thead>
<tr>
<th>Topic</th>
<th>Content</th>
<th>Broad Objectives (Behavioral &amp; attitudinal)</th>
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<tbody>
<tr>
<td><strong>Natural Resources:</strong></td>
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<tr>
<td>1. Soil</td>
<td>Simple properties. Formation. Sand &amp; clay. Effect of water on soil.</td>
<td>Pupil will be able to:</td>
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<td>Erosion &amp; prevention. Soil deposition in relation to topography. The soil</td>
<td>Describe &amp; recognize properties &amp;</td>
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<td>deposition in relation to topography. The soil</td>
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<td>habitat. Plant &amp; animal associations. Soil</td>
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<td>fertility &amp; value to agriculture. Recycling</td>
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<td>of organic matter in soil. Land treatment:</td>
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<td>see Agriculture. Soil fertility: see Decaying</td>
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<td>Matter &amp; Materials We Use.</td>
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<tr>
<td>2. Grass</td>
<td>Occurrence in natural environment (e.g., veld, roadside verges, open</td>
<td>Indicate awareness of grass prevalence &amp;</td>
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<td>land, school grounds). Characteristics &amp;</td>
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<td>variety; runner &amp; tufted types; erosion</td>
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<td>control. Grass as a habitat for small</td>
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<td>organisms. Veld grass as a major food</td>
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<td>source for livestock; grazing &amp; recovery.</td>
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<td>Veld improvement. Veld fire. Foot pressure-</td>
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<td>playing fields. Uses of grass. Utilization</td>
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<td>of grazing &amp; browsing vegetation.</td>
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<tr>
<td>3. Trees</td>
<td>Occurrence, properties &amp; variety. Effect of trees on the social &amp; physical environment (serve as meeting places, provide shade, leaf litter). Tree as a habitat for other organisms. Trees as a food source (browse &amp; fruit). Trees as a major resource for fuel, building poles, sawn timber &amp; paper. Timber quality (hard &amp; soft wood, desirability of straight trees for sawing). Indigenous forest resource. Depletion of trees in TTL's. Trees as a renewable resource. Tree planting. Maintenance of small Eucalyptus plantations. Forestry in Rhodesia--exotic plantations.</td>
<td>Pupil will be able to: Identify parts &amp; functions of a tree, quantitatively measure various aspects &amp; determine basic tree shapes; show appreciation of trees as a habitat and as a source of food for other animals &amp; man; further justify the value of trees as a resource for fuel, building materials, furniture &amp; paper; discuss implications of tree depletion in TTL's, demonstrate awareness of trees as a renewable resource; plant &amp; maintain trees &amp; show a desire to do this; report on indigenous &amp; exotic forests in country.</td>
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<tr>
<td>4. Water</td>
<td>Properties, how used in school &amp; local community. Clean &amp; dirty water, filtration; measurement of volume and calculation of amount used by people. Man's dependence on water. Inter-relationship between water, plants &amp; animals. The water habitat. Water cycle, rain, catchment areas, rivers. Water storage. Protected and unprotected water. Uses of water in industry &amp; agriculture. Water as a source of power. Water as a means of transportation, e.g., sewage, boat on river &amp; sea.</td>
<td>Demonstrate understanding of the properties of water; give reasons why it is important to man, the school &amp; local community; measure liquid volumes and calculate quantity used by people in a set period of time; prove that plants depend on water; explain why animals need water; show awareness of the inter-relationship between water, plants &amp; animals; recognize that water itself provides a habitat for other organisms; explain how water cycles through the environment, why water collects in certain areas and the</td>
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| 5. Plants & Animals   | Variety in animals, e.g., in size, shape & locality; associations between form & function; dependence of animals on plants for food & shelter. Variety in plants, germination & growth of seedlings, measurement. Basic requirements of plants and animals. Special habitats, e.g., under stone, log, in compost. Flowers and seed production. Eggs. Insect life cycle. Encounters/experience with selection of animals, e.g., domestic animals (see Agriculture), wildlife animals, tame animals (& pets), snails (land & water), flies, mosquitoes, rats, pests (see Agriculture), useful animals (bees, crows, swallows, silk worms & insects used for food), animals present in local environment, e.g., frogs, spiders, beetles, snakes. Predator-prey relationships. Food chains (see Health & Hygiene). | effects of rain on the terrain; demonstrate water storage using models; identify safe and unsafe water; give instances of water use in industry, recognize that water is basic to agriculture; explain simply how water can be used for power; demonstrate transportation by water. Pupil will be able to: Compare a variety of animals and plants in terms of differences and similarities; relate form to function; show awareness of the dependence of all animals on plants; demonstrate appreciation of the basic requirements of plants and animals and of inter-relationships within a habitat; set up a system for seed germination and comment on resultant growth and development, measure growth in plants; recognize that flowers produce seeds and animals produce eggs for passing life on; set up and maintain a suitable habitat for keeping small animals, e.g., insects; record changes & behavior based on regular observation of such animals in captivity; show an interest and understanding of animals in the local environment, cite examples of food chains, reveal knowledge and express a
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<tr>
<td>Energy</td>
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<td>Recognize the prevalent use of wood &amp; paraffin as fuel in rural &amp; township homes; calculate number of trees and bottles of paraffin needed per family per year; suggest consequences of depleted timber resources; rear &amp; care for tree seedlings, plant &amp; maintain these during the remaining years when pupil is at school, show a desire to grow trees; explain changes during burning; give reasons why people need fuel; explain simply how and where coal &amp; crude oil formed; discuss coal resources in country and problems relating to oil supplies; identify fuel and other products from crude oil; show awareness that food is a fuel for man and that fuel gives energy; identify energy producing foods, show awareness that electricity supplies energy and is derived from water and coal; give reasons why it is easier to supply homes and industry with electricity rather than coal; demonstrate how solar energy can be used for heating water,</td>
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<td>7. People</td>
<td>Numbers of people that make up a family unit, a class, a school, a community; populations build up in numbers, in relatively few generations; increasing numbers of people require more land &amp; resources; these do not expand with demand; food requirements per person per year and the land required to produce this. Problems and needs of large families; relationship between healthy children and family size.</td>
<td>drying and cooking food; suggest ways in which solar energy might be used in the future.</td>
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<td>Calculate numbers of people in a family unit, class, school and community; demonstrate how population numbers build up in relatively few generations; show appreciation of the problem brought about when increasing numbers of people demand more land and resources; estimate the amount of land required to meet the food requirements for one person and hence of a community of people; identify problems created by large families; explain why ensuring the health and survival of young children in a family lessens the desire of parents to have more and more children.</td>
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<td>8. Decaying Matter</td>
<td>Organic matter (dead plants and animals and anything produced from them, especially dung) slowly gets broken up into smaller and smaller pieces; some large animals (e.g., hyena, vulture) and some small animals (e.g., dung beetles, ants &amp; termites), fungi and germs are agents of decay; minute pieces of organic matter are returned</td>
<td>Demonstrate that dead plants, animals &amp; dung decay and change; identify agents of decay, explain using flow-cycle diagram the system of decay, i.e., breakdown &amp; release into soil of small pieces, reabsorption and assimilation by plants, transfer to animals; suggest problems that would arise on the land surface if there were no decay; make</td>
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<td>to the soil and make soil more fertile and easier to work. Tiny pieces are absorbed in water by plant roots and help plants to grow, become part of plants &amp; part of food, part of animals. When these die, the tiny pieces are released by decay and go back into the soil again. Decay cycle. The process of decay removes dead carcasses from land surface. Compost, manufacture and use in gardening. Non-organic matter does not decay—refuse problems.</td>
<td>compost &amp; justify its value in gardening; show awareness that non-organic matter does not decay; give reasons why substances that decay do not cause the long term problems that non-biodegradable substances present.</td>
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<tr>
<td>9. Balanced World</td>
<td>Components of the world system, i.e., natural resources, plants, animals &amp; germs. A closed system, with only input being sunlight and sun-heat. World system is not static, but dynamic. Plants &amp; animals grow and die, matter changes &amp; cycles (is used over and over again). Animals depend on air and water and plants for food; plants depend on air, water &amp; soil &amp; light. Components balance each other. Dead plants and animals go back into the soil (decay cycle). Water and air cycles. Modern man has changed the natural system by mining and manufacturing, monoculture, producing poisons, building cities and increasing</td>
<td>Identify components of the world system and explain that it is a closed system containing life, that only sun light &amp; sun heat enter from the outside; set up a model of &quot;a world in a bottle,&quot; liken this to the real world and point out the essential resources present, monitor changes and answer the question &quot;how do you know that your 'model world' is balancing itself?&quot;; describe sequences in flow cycle diagrams &amp; demonstrate awareness of the same matter being used over and over again; predict consequences of buildup in animal populations; justify the importance of fertile soil in a living world system; identify ways in which man has upset natural</td>
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<tr>
<td>Agriculture</td>
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<td>Pupils will be able to: demonstrate a positive attitude toward the value of agricultural production in the country; show awareness concerning a range of crops &amp; animals which are important in food production and the country’s economy; identify simple requirements for their production; relate crops to climate &amp; topography; recognize that soil, water, fertilizer, and management are necessary for large scale food production; demonstrate a positive attitude to increasing productivity of small scale food</td>
</tr>
<tr>
<td>10. Plants &amp;</td>
<td>Fish, properties, water vs. land habitats, fish as food for man, food chain, catching &amp; farming fish.</td>
<td>balance &amp; suggest what measures could be taken and how life styles can be altered so that man lives in better balance with his environment; show appreciation that man is an animal and therefore is dependent on the same natural resources as other animals, i.e., water, air, and plants for food; demonstrate appreciation of the problems of development in a rural tribal area without depleting natural resources; role play points of view from various members which make up rural society.</td>
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<td>Animals</td>
<td>Poultry, characteristics, rearing for eggs &amp; meat (or rabbits).</td>
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<td>Food crops, e.g., maize, sorghum, rapoko, wheat, sugar cane, sunflowers, groundnuts, etc.</td>
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<td>Cash crops, e.g., cotton, tobacco.</td>
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<td>Monocultivation, pests. Important crops in African countries &amp; beyond.</td>
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<td>Crops from trees, e.g., citrus, coffee (&amp; tea).</td>
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<td>Vegetables, garden farming, mixed</td>
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<td>11. Land Treatment</td>
<td>Ploughing, digging; effect on soil; effect on seeds; effect of rain on ploughed/dug soil, bare soil &amp; covered soil; cultivating &amp; weeding, effect on plant growth; fertility trench, construction &amp; value in water shortage areas; mulching with litter or stones, water retention. Fertilizer: see Materials We Use. Compost: see Decaying Matter. Prevention of erosion: see Soil.</td>
<td>Compare soil before ploughing/digging and after; recognize the advantages of a ploughed/dug habitat for seed germination; demonstrate the effect of &quot;rain&quot; on ploughed/dug soil, bare and covered soil; give arguments for and against cultivation &amp; weeding around crop plants; demonstrate how a fertility trench is made; explain its value in water shortage areas; set up an experiment to investigate the effect of mulching on vegetable growth.</td>
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<td>12. Sun &amp; Cosmos</td>
<td>Sun is a hot ball of fire very far from earth; earth, stars &amp; moon are floating spheres. Composition of earth, center hot, overlaid by rocks, surrounded by air &amp; clouds which give</td>
<td>Pupil will be able to: show evidence of a 3-dimensional understanding of the earth, sun, moon &amp; stars as floating spheres widely separated from each other; describe, using a 3-dimensional</td>
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<td>13. Weather</td>
<td>Characteristics of different kinds of weather, e.g., hot, cloudy, rainy, cold, dry, windy; recording weather; reading weather signs, e.g., build up of storm clouds; simple predictions; weather stations; storms, thunder and lightning; dangers &amp; protection (electricity); seasons, summer (hot and dry, hot and wet); winter (cold and dry); seasons in other countries; temperature—simple assessment using heat sensitive areas of skin; attitude model, the earth's composition; point out on a model how air &amp; clouds surround the earth; demonstrate how a shadow is formed; demonstrate using a ball how the earth rotates on its axis and how this in conjunction with a light source produces night &amp; day; demonstrate using models how the earth moves around the sun; show appreciation of how sun &amp; air are essential natural resources; demonstrate things floating in air; identify the properties of floating objects; demonstrate how moving air can do work; explain simply using a flow diagram how light from the sun provides a leaf with energy to make food. Show awareness that food contains energy.</td>
<td>Report on &quot;today's weather,&quot; recognize weather signs; attempt to predict weather on the basis of actual observation; demonstrate awareness of weather stations; describe, draw, mime the drama of a storm; recognize safety precautions which minimize dangers of lightning; compare seasons; assess temperature using skin sensitivity; demonstrate awareness of altitude and its relationship with temperature; measure wind direction, rainfall; interpret rainfall</td>
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<td>&amp; relationship with temperature; wind direction; rainfall measurement; interpreting rainfall maps; effect of rain on environment; how animals behave in rain; how man protects himself from rain; weather conditions in neighboring countries, their influence on weather here.</td>
<td>maps, identify changes in environment brought about by rain; show awareness of reactions to rain by animals and man; show appreciation of weather transcending national boundaries.</td>
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<td>14. Land Forms and Minerals</td>
<td>Stones—shapes, colors, textures, hardness; granite—composition, origin of clay and sand; local features of topography, e.g., hills, slopes, flat areas, kopjes, valleys, water courses; indications of man changing topography, e.g., earth works, quarries; dams; effect of rainfall on watershed, sedimentation; major features of land mass in country, e.g., eastern mountains, highveld, middleveld, and lowveld; occurrence of granite, sandstone, earth structure, faulting scale distance, time, direction, compass; map making, and interpretation of maps; local line transect; important mineral deposits in country, e.g., coal, ironstone; mining principles, equipment, and operations.</td>
<td>Pupil will be able to: Compare and recognize properties of stones, show appreciation of the wide occurrence of granite in the country and its sand and clay derivatives; recognize features of local terrain and main features of land mass in country; demonstrate using a simple model how differences in topography arose by faulting; demonstrate awareness of the effects of rain and runoff; construct and interpret maps of local surroundings; demonstrate the use of scale, identify and record direction, measure distance, relate time and distance, construct a local line transect; interpret and use a map of this country to locate important river systems, agricultural areas and mineral deposits; show awareness of mining principles, equipment and</td>
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<td>Physical Environment: Man Made:</td>
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<td>operations; show awareness of sea and continental land masses.</td>
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| 15. Tools & Machines         | Natural tools of man, e.g., hand, arm, foot (for squashing and pressing), teeth; natural tools of animals, e.g., claws, beak, teeth, tail, horns. First tools that man invented, e.g., stones (for throwing and killing, scraping, grinding), spears, bow and arrow. Tools help man do tasks; household tools for cutting, transferring food, sweeping; garden tools for digging, cutting, transferring water, cultivating. Agricultural tools—the plough; tools which help solve problems of, e.g., pushing in a nail, turning a screw, breaking wood into small pieces, moving a heavy stone, opening a bottle, turning a nut on a bolt, making a hole in wood, cutting wood into straight planks, joining pieces of material together, moving a small object a long way (e.g., sling, gun, hockey stick golf club). The problem of friction when one object moves against another, e.g., scotch | Demonstrate how man uses parts of his body to do tasks; explain using pictures how animals similarly accomplish tasks; make models of tools that man invented long ago and demonstrate how these were used; identify household, garden tools and the plough; recognize the tasks they accomplish; show appreciation of how these extend the ability of man to manipulate his environment; demonstrate how problems can be solved by using a variety of tools; demonstrate how friction occurs, explain how problems involving friction may be overcome; show appreciation of the significance of the invention of the wheel; make a model of a streamlined shape and indicate how this principle is applied in fish, ships, cars, and airplanes; demonstrate how a simple pulley can be used to raise and lower heavy masses; show how it is easier to raise objects using an inclined plane than by pulling vertically; recognize how these
### Table 20.—Continued  Draft Core Syllabus, Environmental Science

| Topic | Content | Broad Objectives  
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<td>cart over ground—solution, the wheel, e.g., hub of bicycle wheel, moving parts in engine—solution, oil; e.g., when an object moves through air or water—solution streamlined shape. Machines with wheels which enable man to transport heavy things, e.g., wheelbarrow, cart, trailer, lorry. Machines which help solve problems, e.g., lifting water from a well, lowering and lifting people in a mine, getting rocks out of a mine (pulley/inclined plane).</td>
<td>principles are applied in mines and other relevant situations.</td>
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<td>16. Materials We Use</td>
<td>Properties and uses of following: paper, plastic, glass, wooden plank/pole, cloth, leather, rubber, soap, cooking oil (crude oil—see fuels), metal, paint, cement, concrete, bricks, pottery, fertilizer; origin of materials—from earth, e.g., rocks or from plants and animals; some resources from which materials are made are finite, e.g., crude oil, certain ore bearing rocks; other resources are renewable, e.g., trees, plants, animals; some man-made materials can be reused and recycled, e.g., paper, plastic, metal, glass.</td>
<td>Identify and compare properties of a variety of materials; point out how these are used; show appreciation of the awareness value of these materials to man and of the processing of these materials by man; demonstrate awareness of resources used to make these materials and of the finite nature of certain resources; show concern toward wastage, reveal a willingness to recycle or reuse materials such as paper, plastic, glass, and metal; demonstrate support for replacing renewable resources, e.g., trees.</td>
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<td>17. Infrastructure</td>
<td>Communication—Systems for linking places, i.e., paths, earth roads, tar roads, bridges, railway lines, telephone and electrical wires; comparison and function of path, earth and tar road (where applicable); comparison and function of road and railway line; materials used to make earth roads; drainage; materials used to make bridges; shape and support; a road or street system involving, e.g., vehicles, pedestrians, road safety, bus stops, garage, drains, poles for wires; system for fencing land—reasons for, poles, wire, gates, cattle grids; dam building—construction of earth wall, shape, problems, irrigation canals; communication without wires, e.g., radio and television. Electrical wires link source where electricity is made to consumers. Electricity carrying wires are dangerous—hence wires are underground or carried high overhead on poles/pylons.</td>
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<td>Compare systems for linking places; show appreciation of the value of communication systems for the development of an area; show how materials forming an earth road can be analyzed; make models of earth roads, bridges, fences, dam walls, irrigation canals, and use these to explain their function, how they are constructed and the proper materials that should be used in construction; identify and present in chart form the components of a street/road system based on local observation; recognize that systems of communication include wires which link one place to another but that communication is possible without wires; show awareness of how electricity is carried to minimize danger; identify and acknowledge major features which have led to significant development in this country, e.g., Kariba hydroelectric scheme, irrigation system for lowveld. Show awareness of the potential for further development.</td>
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<td>18. Pollution</td>
<td>Pollution of land, water, and air; clean and dirty surroundings, clean and dirty water, household rubbish, location, sorting into that which is</td>
<td>Describe how land, water, and air can become polluted; show concern for the effect of pollution on health and natural systems; sort rubbish into that</td>
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<tr>
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<td>19. Health &amp; Hygiene</td>
<td>Healthy habits; body cleanliness, how to keep home, school, and surroundings clean; importance of clean air and water, food, exercise, rest, and family happiness. Dental care; simple first aid including treatment of sores, cuts, and burns; germs—properties, link with disease, killing germs and preventing spread of disease. Proper toilet habits and care of toilets, types of toilet including Blair ventilated pit and</td>
<td>Describe and demonstrate healthy habits, show a positive attitude to personal appearance and cleanliness, cleanliness in the home and school and toward health of the local community; recognize the importance of clean air, water, and food; explain what germs are, how they cause and spread disease; demonstrate simple first aid treatments; show appreciation of the need for good sanitation in order to protect people from disease; recognize the role of</td>
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<td>useful for compost and not useful, rubbish disposal; methods of cleaning water, filtration, boiling; industrial waste, industrial pollution of water; pollution of land and water due to inadequate toilet facilities; pit latrines and water borne sewage (where applicable); oil pollution of sea; oil spills, hazards and ways of dispersing oil slicks. Noise pollution; pollution upsets natural cycles, e.g., in water, affects health and wellbeing of man.</td>
<td>which is useful for compost making and that which is not; demonstrate the correct disposal of household rubbish; show appreciation of the problem of disposing of a city's waste (where applicable); demonstrate awareness of the problem of land and water pollution in areas where inadequate toilet facilities occur; suggest ways by which this may be overcome; demonstrate simple filtration of water, describe how pollution may be caused by unseen germs and poisons; give examples of excess noise and state why this is detrimental to man's wellbeing; reveal a willingness to behave in such a way as to minimize pollution.</td>
</tr>
<tr>
<td>Topic</td>
<td>Content</td>
<td>Broad Objectives (Behavioral &amp; attitudinal)</td>
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<td>method of minimizing fly hazard. Food—food chains, three main types of food, reasons for malnutrition and kwashiokor, essentials of a balanced diet, growing good goods in garden, storing food; value of breast feeding, weaning and requirements of children aged 1-5 years; importance of child health in population stabilization. Some common diseases and their prevention, e.g., gastro enteritus, colds, chest infections, measles, parasitic worms; immunization program for children. Vermin and spread of disease, e.g., rats, cockroaches, fleas, lice, ticks, bedbugs. Bilharzia life cycle, safe and unsafe water (see Water), effects and prevention; hazards of smoking and alcohol.</td>
<td>nutrition in health for all people, particularly the 1-5 age group; give arguments why breast feeding is important for babies; identify common diseases, discuss their effect and prevention; show a positive attitude toward immunization programs; recognize and suggest ways to eradicate disease carrying vermin; explain using a flow cycle diagram how Bilharzia is caused and spread and how the disease can be prevented; identify protected and unprotected water, show appreciation of the problem of Bilharzia in rural areas and a willingness to behave in such a way as to prevent spread and contamination of water sources; demonstrate awareness of the hazards of smoking and alcohol to personal health and family welfare.</td>
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<td>20. Body Systems</td>
<td>External features of body, function, unique abilities of hands, feet, legs, and arms; senses, their usefulness in bringing information to the body about the environment; growth--foot and hand size, height, chest measurement, mass, size of steps, silhouettes of members of family unit to contrast shape and height; inside of body, properties--warm and moist, blood and pumping</td>
<td>Describe, act out, what parts of the body can do, how senses are used to find out about the environment; measure, categorize, and record heights, circumference of chest, mass, space between steps of pupils, contrast shape and size of members in family unit; show appreciation of properties within the body; give an account of the development of the moving system from</td>
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<tr>
<td>Topic</td>
<td>Content</td>
<td>Broad Objectives (Behavioral &amp; attitudinal)</td>
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<td>heart, muscles and bones; system for moving--development from kicking baby to running child, changes in shape, strength of limbs and backbone, balance, uses of the two &quot;free legs&quot; (arms), function and interaction between bones and muscles; system for eating and drinking--function of mouth parts, gut/pipe--through body, stomach for mixing; system for breathing--air into lungs in chest and out, something taken out of air for use by body; skin, a system for sensing and keeping the outside out and the inside in; system for passing life on--child in womb, birth, change from womb environment to outside, age changes from child to old person; death, living and dead, living and non-living, lifeline maintained by man passing precious drop to precious woman to join with tiny egg inside her, egg and life drop contain messages about father and mother, hence the child which develops from joined egg resembles something of both parents; system for getting energy from food--broken down into very small pieces, some pass through gut pipe into blood, taken to muscles, together with that part of air absorbed in lungs. Very slow burning of tiny food pieces</td>
<td>baby to upright running child; demonstrate using flow diagram and model, the system for eating and drinking; demonstrate breathing and explain that something from the air is taken from the lungs into the body; demonstrate how the skin can be used for sensing, show awareness of its properties as a limiting layer; compare womb environment to outside air environment, interpret changes using flow diagrams in the development of child to old person; compare living and dead, living and non-living, describe using a flow diagram how life is passed on from one generation to the next; explain using flow diagram how energy from food is released in muscles to enable movement and activity; identify changes between an active and inactive body; show appreciation of man being special and different to animals by virtue of his thinking brain, identify thinking processes that are not apparent in animals and demonstrate problem solving, memorizing; reveal a desire to enable brain to learn as much as it possibly can.</td>
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<tr>
<td>Topic</td>
<td>Content</td>
<td>Broad Objectives (Behavioral &amp; attitudinal)</td>
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<td>in muscles produces energy and heat, when body active uses more energy, breathing and heartbeat increase, more food needed; a system for thinking--brain, man different to animals, can plan, imagine, memorize, solve problems; animals do things without thinking, sometimes man does this too, but mostly he decides how he will behave. Man's brain goes on and on learning.</td>
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CHAPTER 7

VALIDATION AND RECOMMENDATIONS FOR FUTURE DEVELOPMENTS

The completion of the Environmental Science Curriculum plan marked the end of the first major stage of the project. This coincided, as planned, with the completion of the Environmental Social Studies plan. Since the two Working Parties had been working in liaison from the beginning of the project, only a few working sessions were required to review and coordinate the two in relation to each other.

A one-day review workshop was planned for the joint presentation of these two plans to representatives of various ministries such as Health, Education, and Agriculture; of various university departments; of commerce and industry; and of many community and government agencies. A list of those invited to participate is included in Appendix M. The composition of the three discussion groups which reviewed and discussed the plans after they were presented at the workshop on December 8, 1978, is shown in Appendix N.

In a way, this occasion also marked the integration of the African Division and the European and Coloured Division of the Ministry of Education into one education system with only five Provincial offices. Figure 11 shows the new subdivisions of the integrated system. The primary schools in the European and Coloured Division consisted only of 151 schools with a total enrollment of 36,129 pupils (Rhodesia, 1978b) compared with 3326 schools and an enrollment of 855,025 in the African...
Figure 11. New Subdivisions of the Integrated Ministry of Education
Division (Rhodesia, 1978a), so it was natural to amalgamate the European schools into the Environmental Studies program as designed under the former African Division.

Thus, the representatives from the Ministry of Education, who participated at the review workshop, represented the interests of black, white, and coloured primary school children and teachers. Three science advisors from the former European Division were also invited to participate. (They subsequently became a part of the Environmental Science Working Party.)

The curriculum plans generally received an enthusiastic reception from the participants. For many who had been consulted and involved in one way or another with the project, there were few, if any, surprises. For the large majority of the others, it represented a welcome innovation, which they showed interest in supporting.

Soon afterward, after a meeting of the Working Parties, Environmental Education Committee, and Education officials, the Ministry gave its approval for continuing into the next stage of the project, and for implementing the curriculum at Grades 1, 4, and 6 of the primary schools of the country by 1980.

**Validation**

The curriculum plan, as presented at this point, was the culmination of a year's work of survey, research, and innovation. The criteria for validation of the procedures were met as follows:
1. The curriculum plan which was developed complied with the requirements of the Ministry of Education. The newly integrated Ministry gave its approval for implementation.

2. The introduction of the environmental science course into the school curriculum was acceptable and seen by teachers, pupils, and administrators as being relevant and desirable. This was verified through the results of the questionnaires, interviews, and pupil feedback.

3. The course, as planned, is appropriate to teacher competencies and available facilities. This criterion was met up to a point through survey of the facilities, study of teachers' educational backgrounds, classroom observation, interviews with teacher trainers, and classroom teacher trials of new Units. However, more evaluation of this area will be needed after inservice training begins.

**Recommendations for Future Developments**

Immediate future activities will be largely centered on the production of materials. At the same time there has to be a major thrust to ensure that the curriculum plan is transformed into reality. It has been found that often a very wide gap exists between the curriculum in the Ministry and the actual curriculum in schools (Hawes, 1977, p. 155). To prevent this from happening, future developments will need to revolve around three major areas: (1) production of materials, including field trials; (2) teacher training; and (3) evaluation.
Production of Materials

Decisions have been made to produce a teachers' resource book and a pupils' group activity book for each grade (Chapter 4, Materials). Topics, concepts, skills, attitudes, and behavioral objectives to be achieved have also been suggested (Table 19). The following step, then, will be the writing of the individual lessons within a unit for grades 1, 4, and 6 with continuing field trials. To carry out this task, it is planned that the Environmental Science Working Party of three members be enlarged to six (integrating the science advisors of the former European Division of the Ministry into the program). This work will entail very close liaison with the Environmental Social Studies Working Party who will also be producing materials for the same three grades. It seems desirable to adopt similar writing styles and degree of flexibility, and to guard against duplication of material, yet still build the important links between the social and science aspects of environmental studies.

Of paramount importance will be the field trials of the materials as they are developed to ensure that the objectives and spirit of the curriculum are being appropriately communicated to the teacher; that the demands made on the teacher, pupils, and facilities are not unreasonable; that the drawings in the pupil activity books are perceived; and that the language level is appropriate for both teachers' and pupils' materials.

A study conducted by John Hofman in Rhodesian primary schools using the cloze technique (Taylor, 1952) to determine reading proficiency, found that "judging by item norms, the present curriculum is at least a year or two ahead of readability. Materials taught at a certain grade
level become understandable to the average child only a year or two later" (Hofman, 1974, p. 40).

In evaluating African Primary Science Program materials, the Lorge formula for estimating the difficulty of reading materials was used for calculating the readability indices of three APSP units. It was found that:

1. The teachers' guides were all within the range of comprehension of the majority of Grade II teachers. The most difficult unit was a readability index of 6.84 while the 25th percentile for Grade II teachers is 7.15;

2. For the majority of primary schools, there may be difficulty with the pupils' materials. Five of the eight books analysed had readability indices of 4.82 or higher. At least half of primary 6 children in the sample tested (median reading level 4.73) would have difficulty with these materials (Yoloye, 1975b, p. 12).

These two studies provide evidence to show how important it is that materials for the Environmental Science Curriculum should be pre-tested before being placed at certain levels and generally implemented.

Teacher Training

In order to ensure the success of implementing the new curriculum, there appears to be good justification to take steps in the area of teacher training as soon as possible. Dyasi (1977) emphasizes the importance of teacher training in relation to realistic evaluation of outcomes of a program. In the African Primary Science Program evaluation report, Yoloye (1975b, p. 9) stated: "One fact that has become quite clear to evaluators is that the key problem of the program is teacher training." Again, he said "Until the problem of teacher training is solved, i.e., the problem of how one gets the primary school
teachers to interpret and practice correctly the APSP spirit, evaluation of outcomes on the children, teachers, and others will remain seriously handicapped" (Yoloye, 1975b, p. 9).

In fact, it was cognizance of the need to integrate curriculum development, initial teacher training, and inservice training that largely prompted the team to make visits to the major teacher-training colleges in the country and to the Regional Education Officers. During these visits, the team presented their proposals for the curriculum and then sought the participants' views on various aspects such as content, approaches, methods, materials, and manpower. (A report of these visits is presented in Appendix I.) At the same time, suggestions were made as to how the now-existing environmental education courses at teacher training colleges can be modified to provide student teachers with the required competencies for teaching Environmental Science as envisaged. At present all student teachers receive a 10-week course of some 40 hours of environmental studies. At six colleges, environmental studies is now offered as a main subject as well. Basically, therefore, the foundations for environmental studies at teacher training colleges has been laid. This is quite an achievement, when one considers the fact that the first 55 locally trained teachers entered the classroom relatively recently in 1941 with Primary Teachers' Lower (P.T.L.) Certificates. This meant that after completing six years at primary school, they had done two years' teacher training (Taylor, 1970, p. 14).

As a result of the meetings with the Environmental Science Working Party, three of the colleges, Umtali Teacher Training College, Mokoba Teachers College, and United College of Education, decided to
incorporate into the student teachers' final year's work, a period of time for practice in Environmental Science Curriculum development and teaching. The experiences gained, and successful lesson units produced, will then be relayed to the Environmental Science Working Party which will be engaged in producing materials. Also, there will be continued liaison.

**Initial Teacher Training.** It is important to make provision for initial teacher training that will prepare beginning teachers to face the realities of the curriculum which they will meet in school. However, at present, the total output of all the teacher training colleges constitutes only a very small fraction (roughly 2.7%) of the total teaching force. For example, in 1977 the total output was 550 and the total teaching force was 20,565 (Rhodesia, 1977). Therefore, additional provisions for teacher training have to be made.

**In-Service Training.** This type of training is recommended not only for the teachers, but for the supervisors and headmasters as well.

Supervisors: In the system, it has been the supervisors who have been responsible for introducing curriculum reforms to the teachers, and who have been largely responsible for in-service teacher training as well as for assessing teachers' performance in the classroom. Although this method has been effective in maintaining close teacher Ministry liaison, it may not be an ideal situation to have the same person who trains the teacher in the field also to have the responsibility of rating his teaching ability on the job. The teacher, in trying to create a good impression, may not feel as free to ask for help
in weak areas. However, even if the system should be changed in the near future, the supervisor will continue to be a very important advisor to the teacher. Thus it is imperative that he be trained to fully understand the requirements of the new curriculum in terms of teacher competencies, teaching-learning techniques, materials, etc., especially since there will be departures from established patterns. For example, in assessing a teacher, the pupils' notebooks are regularly examined by the supervisor. Consequently, much effort is now expended in laborious writing, copying, ruler work, and decorations. This will now be de-emphasized, so it is important that teachers not be penalized.

Headmasters: The headmasters play a crucial role in the implementation of a new curriculum. Discussions with teacher trainers and with newly-trained teachers entering the system reveal that unless the headmaster supports new teaching approaches, the teachers soon fall into old, "accepted" patterns in order not to jeopardize their jobs and qualify for promotions. In many ways such as in calling for the use of school grounds for experimentation, the new curriculum will make various demands on headmasters. Therefore they too must be "trained" in the new curriculum. At present, although most headmasters have not had any environmental education training, those which were approached and consulted during interviews, questionnaires, at headmaster courses, and at a workshop sponsored by the Conservation Trust proved very receptive to the new curriculum as envisaged.

Two means by which headmaster in-service training may be promoted through existing channels are: (1) through the two-week headmaster courses now being held periodically at Domboshawa Training
Institute, and (2) through periodic weekend and holiday workshops sponsored by community and public agencies such as the Conservation Trust or Department of Parks and Wildlife. In this way, environmentalists can share their expertise and interest in the environment with headmasters, and community-school links can be forged. One such workshop was sponsored by the Conservation Trust and organized by Conservation Awareness Workshop in August, 1978, in association with the Environmental Science Working Party. Sixty educators (education officers, supervisors, and headmasters) participated. The program included guided field trials in a nearby National Park, talks by environmentalists, and discussions on the topic, "How can the outdoors be used in education in schools?" The outcomes of this workshop were very promising, and augur well for similar future ones.

With regard to teachers, the short-course method of in-service training commonly organized to introduce new programs in schools has been found generally unsatisfactory due to lack of time and resources (Hawes, 1977, p. 163). One method which seems promising is a school-based one currently being used in Swaziland. The students first attend a six-week residential course then follow a closely-monitored correspondence program, and are regularly visited in schools (International Bureau of Education, 1977, pp. 4-6). Another possibility is to establish district teacher-training centers which could also serve as community schools, or be associated with existing schools. Resource teachers appointed to those centers would work closely with the teachers in that district.
Two other means of in-service training are (1) through the use of radio lessons, which have been found to be very effective in primary schools (Robson, 1974). Regular teacher training radio programs on the new curriculum could be broadcast, requiring feedback from teachers and follow-up in the school. (2) Through the use of fully equipped mobile teacher-training teams who would hold workshops in different schools. Since the school day now ends at 1 p.m., the afternoons could be used for holding the workshops.

An important consideration is that one of the main weaknesses of the present Discovery Science curriculum was the failure to communicate the teaching-learning strategy to the teachers (Rhodesia, 1975). In order to prevent this from reoccurring, a good hard look must be taken at the present in-service training methods, and appropriate action taken as soon as possible. It will be imperative to provide the best teacher training possible for the initial implementation of the curriculum. Otherwise, the whole plan could collapse before it is fully operational.

Evaluation

The development of materials and the recommendations of teaching strategies and practices for the new program have, and are now being carried out, on assumptions about the teacher, learner, and learning environment founded primarily on subjective experience. Whereas this is acceptable and even necessary at this stage of the development of the curriculum, it is important that at least the major assumptions be tested to see whether they hold true and are appropriate.
Evaluation must be made not only of the materials as they are being produced, but also of all the other aspects of the program, such as instructional strategies, resources, teacher training methods, and pupil and teacher outcomes. The following questions need to be answered:

1. Have the objectives of instruction been met?
2. Is this program better than the one it is expected to replace?
3. What additional effects has the program had, and to what extent are these better or worse than what existed? (Gagne and Briggs, 1974, p. 232).

Scriven (1967) introduced the concept of formative and summative evaluation. Formative evaluation attempts to provide data about the feasibility and effectiveness of a lesson, unit, or program while it is still being developed. The data gathered are used in making revisions and improvements. Evidence is sought from observers, teachers, and pupils. Summative evaluation is undertaken to determine the effectiveness of the course or program, once it has been implemented.

Formative Evaluation. The use of questionnaires, interviews, and classroom trials were means whereby the team gathered data which were used in validating objectives determining domains and revising and improving the units as they were being developed. In addition the practice of actual classroom trials before the units were written up for Teachers' use was such that much evaluation of the pupils' and teachers' predispositions, economic administrative setup, sociocultural setting, and school facilities was done intuitively on the job by the team, and
their assessment influenced the development of the units. This kind of evaluation will still need to be carried out in the development of additional units. In addition, it is envisaged that more widespread field trials will be undertaken.

It is recommended that the formative evaluation on instructional materials also include studies on the reading difficulty of the materials intended for teachers and for pupils. Picture perception tests might also be of value in determining which type of diagrams and pictures are more easily understood. Also formative evaluation studies should be conducted on proposed manpower training programs.

Summative Evaluation. Although this type of evaluation will be conducted for the purpose of determining whether the Environmental Science curriculum will "work" it is necessary to make important decisions and plans now, such as determining the nature of the summative evaluation study, the manpower needs for evaluation, and the technicians which will be used. Such a study will probably entail the development of data gathering instruments specially suited to this program. If this is the case, the production and validation of these instruments will require considerable time. Another important aspect of summative evaluations is that oftentimes it involved comparative studies, for example a new instructional unit or program is compared with an "old" one.

Two such summative evaluation studies were carried out with respect to some outcomes of the African Primary School Program on children by Duckworth (1971) and on teachers by Johnson (1970).
Duckworth compared children in 15 primary school classes which had been exposed to the APSP materials for periods varying from two terms to two years, with children in thirteen primary school classes which had not been exposed to APSP in Kenya on a variety of tasks of intellectual ability and creativity. The tests of intellectual ability included: (1) missing piece, (2) straight line, (3) bilo, (4) lego corner, and (5) ordering weights.

For creativity, a set of materials equally familiar or unfamiliar to the two groups of children were presented to the children and they were asked to do whatever they liked with them. They were then rated by observers in terms of (1) number of different things done and (2) complexity of things done. In general APSP children did significantly better than non-APSP children on all tests.

Johnson compared six APSP classes with six non-APSP classes in Sierra Leone on an interaction analysis schedule based on the Flanders but having 20 behavior categories. Five consecutive lessons were observed in each class:

1. In APSP classes the incidence of pupil activity was higher than teacher activity whereas the reverse was the case in non-APSP classes.

2. APSP teachers used predominantly indirect influence whereas non-APSP teachers used predominantly direct influence.

3. Pupils in APSP classes exhibited more independent behavior than non-APSP classes.
Should the decision be made and approved to conduct similar comparative studies for the Environmental Science curriculum then baseline values and standards have to be determined, and data gathered on the "old" system before the new curriculum is implemented in the schools, since it is envisaged that the new curriculum will be implemented in all the primary schools at about the same time.

Summative evaluation studies which compare a new instructional unit with an "old" one must take into account other variables which influence the outcomes of instructions other than the unit itself. These variables, including the following listed by Gagne and Briggs (1974, p. 254), must be controlled or measured in order to test the effects of instruction:

1. Aptitude variables, reflecting the students' aptitudes for learning.

2. Process variables, arising from the manner of operation of instructions in the school.

3. Support variables--conditions in the home, school, and community which affect opportunities for learning.

Evaluation Models. Bennet (1974) gives valuable guidelines on the design of an environmental education evaluation model. The literature also provides evaluation models which may be used or adapted for use in the Rhodesian situation. Some of the better known models are:

1. The Tyler model of the 1930s--evaluation consists of measuring the extent to which objectives are met. Evaluation in this model is largely summative (Tyler 1950). This model is currently out of favor due to the fact that it ignores all the other variables that affect instruction.
2. The Stufflebeam model—presents a form of system analysis under the four headings of context, input, process, and product. This model requires four types of evaluation:

(a) context evaluation, which helps in defining objectives;
(b) input evaluation, which aids in the making of decisions on matter of design;
(c) process evaluation, which guides decision making on operations; and
(d) product evaluation, which provides data for judging attainments, and hence for revision, termination, or continuation (Phi Delta Kappa National Study Committee on Evaluation, 1971, pp. 201-205).

A weakness of this model lies in the fact that the role of the evaluator is primarily one of data collecting, and the making of judgments is reserved for the decision makers.

3. Provus' Discrepancy Evaluation Model—This is a system-oriented model in which evaluation moves through four main stages: design, installation, process, and product. During the first stage a set of standards, which can be used on a basis of comparison for program performance, is determined. During the following stages, data are gathered which enable comparisons to be made. These comparisons provide a basis for judgments as to whether the program is to be continued, revised, or terminated (Provus, 1971).

4. Stake Congruence-Contingency Model—The evaluator is concerned with three things: antecedents, transactions, and outcomes.
Antecedents are the conditions which exist before the implementation of an intended change, including such matters as the entry level of students, availability of equipment, and trained teachers. Transactions are interactions between student and student, teacher and student, and between people and materials. Outcomes are the intended products of the transactions (Stake, 1967, 1969). Figure 12 depicts the processing of descriptive data in this popular model.

The term congruence, as used in the model, is used to indicate only the degree of match between what is intended and observed, not the validity or value of the outcome. Saylor and Alexander (1974, p. 307) explain contingencies as "relationships among the variables." Contingencies are examined in an effort to determine the "whys of the outcomes."

Saylor and Alexander also believe that this model is very useful in evaluating curriculum plans. Atkinson (1977, p. 3) praises the fact that in this model, the role of the evaluator is made very clear. First, he should produce a clear statement of objectives. Second, he should take part in the collection of data. Third, he should exercise a large measure of judgment in the determination of both absolute and relative standards to be used in assessing the program.

5. Illuminative Evaluation Model--One Major shortcoming of the models presented above is that because there are so many complex intervening factors involved in education it is very difficult to test educational effects under controlled conditions.
Descriptive data

Intended antecedents

↑

Logical contingency

↓

Intended transactions

↑

Logical contingency

↓

Intended outcomes

← Congruence →

Observed antecedents

↑

Empirical contingency

↓

Observed transactions

↑

Empirical contingency

↓

Observed outcomes

Figure 12. Robert E. Stake's Congruence-Contingency Model for Educational Evaluation: "A Representation of the Processing of Descriptive Data" (from Stake, 1969, p. 20).
Another shortcoming is that there is a danger of the evaluation becoming "artificial," in other words, not taking into consideration atypical or "unplanned" situations or effects which may arise in the course of the study. In an effort to overcome these shortcomings, two British evaluators, David Hamilton and Malcolm Parlett, have suggested what they call "illuminative evaluation."

The aims of illuminative evaluation are to study the innovatory program; how it operates; how it is influenced by the various school situations in which it is applied; what those directly concerned regard as its advantages and disadvantages; and how students' intellectual tasks and academic experiences are most affected. It aims to discover and document what it is like to be participating in the scheme, whether as teacher or pupil, and, in addition, to discern and discuss the innovation's most significant features, recurring concomitants, and critical processes. In short, it seeks to address and to illuminate a complex array of questions (Parlett and Hamilton, 1972, p. 9).

This model seeks to evaluate the instructional system then, in the context of the learning milieu which contains a network of cultural, social, institutional, and psychological variables which the authors feel cannot always be controlled or measured accurately.

An illuminative evaluation involves three stages: observation, inquiry, and explanation. In the observation stage, the evaluator will simply try to observe as wide a range of phenomena as possible, without having preconceived expectation. During the inquiry stage, he will select certain phenomena for systematic study thus empirical research
has its place here. In the third stage, the evaluator offers various possible explanations with relative merits.

Atkinson (1977, p. 9) specified three basic ground rules which illuminative evaluators should bear in mind:

1. The problem defines the method—not vice versa. The choice of research techniques will be determined by the need to gather certain data in particular circumstances.

2. Different techniques are combined to throw light on a common problem. No one research method is used exclusively or in isolation.

3. The investigation progressively focuses on specific aspects of the milieu. From an extensive base of information, the evaluator must systematically reduce the breadth of his inquiry to give attention to emerging issues. New information is used to classify and redefine the problem areas as the investigation unfolds.

While this model does not solve all the problems with which the evaluator is concerned, it does offer a very flexible approach and one which might be better adapted to the evaluation of the Environmental Science curriculum because the learning milieu in this case still needs so much exploration and because the emphasis of this evaluation is to aid decision-making for future developments.
APPENDIX A

QUESTIONNAIRE I

3rd May, 1978

Dear

ENVIROMENTAL STUDIES: AFRICAN PRIMARY SCHOOLS

We are a working party of the Ministry of Education and the University of Rhodesia. Our job is to formulate and recommend a primary school syllabus for the new area Environmental Studies. To do this, we vitally need your help.

Would you please fill the form at the back of this page to give us a brief description of at least one concept or main idea you would like included in the course of Environmental Studies, and why. Mention more than one concept or main idea if you like.

Here is an example of an answer:

I THINK THE FOLLOWING TOPIC OR MAIN IDEA WOULD BE VERY IMPORTANT TO INCLUDE IN A COURSE OF ENVIRONMENTAL STUDIES:

The Importance of Trees to Man: Uses for cooking fires and house building. Need for growing more trees.

I WOULD LIKE TO SEE IT INCLUDED BECAUSE:

In our area we are very short of trees and people have to walk far for firewood.

We would very much appreciate your sending your reply to your Provincial Education Officer before the 31st of May, 1978, and look forward to hearing from you.

Thank you very much for your cooperation.

Yours sincerely,

ENVIRONMENTAL SCIENCE WORKING PARTY
PLEASE COMPLETE THE FOLLOWING:

NAME

POSITION (Supervisor or Teacher?)

TEACHING GRADE

SCHOOL NAME AND ADDRESS

TYPE OF SCHOOL (Urban, Rural CPS, or Remote Rural?)

PROVINCE WHERE SCHOOL IS LOCATED

I THINK THE FOLLOWING TOPIC OR MAIN IDEA WOULD BE VERY IMPORTANT TO INCLUDE IN A COURSE OF ENVIRONMENTAL STUDIES:

I WOULD LIKE TO SEE THIS INCLUDED BECAUSE:

ANY OTHER COMMENTS:

(Signed)
APPENDIX B

QUESTIONNAIRE II

Please help us develop a new Environmental Science Curriculum for Grades 1 to 7, by filling in this form:

Part I

Name: ___________________________ School: ___________________________

rural/urban

Position: (teacher, E.O., or Supervisor) ___________________ Grade: ____________

What is your educational qualification? PLEASE TICK (√) THE RIGHT ONE BELOW:

Std. 6 + PTL __________
RJC + T4 __________
RJC + T3 __________
Cambridge + T3 __________
Cambridge + T2 __________
Other ________________

How many years have you taught? __________________________

Part II

Which book do you use to teach Science? __________________________

Which parts of it do you think are most worthwhile to teach? __________

__________________________________________________________________________

Why? ________________________________________________________________________

__________________________________________________________________________

211
Which parts do you think are NOT worthwhile to teach? ___________________

Why? _______________________________________________________________

Which book do you use to teach Geography? ____________________________

Which parts do you think are most worthwhile to teach? ________________

Why? _______________________________________________________________

Which parts do you think are NOT worthwhile to teach? ___________________

Why? _______________________________________________________________

Part III

The purpose of the Environmental Science Curriculum now being developed is:

1. To make pupils aware of their environment and of the relationship to it.

2. To motivate them to behave responsibly to assure survival and to improve the quality of their lives.

3. To provide them with basic skills and concepts in science, gardening, and geography.

Below is a list of topics suggested for an Environmental Science Curriculum. We want to find out how important you think these are to include in order to achieve the purpose of the course.

PLEASE LOOK AT THE TOPIC CAREFULLY, THEN PUT A TICK (✓) IN THE COLUMN UNDER THE HEADING OF YOUR CHOICE. ANSWER FOR ALL TOPICS.
<table>
<thead>
<tr>
<th>TOPIC</th>
<th>VERY IMPORTANT TO INCLUDE</th>
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<tr>
<td>Soil</td>
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<td>Gardening</td>
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<td>Poultry</td>
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<td>Conservation of nat. resources</td>
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<td>Common plants</td>
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<td>Toilets</td>
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<td>Sanitation/hygiene</td>
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<td>Local physical features</td>
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<td>Trees + wood</td>
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<td>Food production</td>
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<td>Animal husbandry</td>
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<tr>
<td>Agriculture</td>
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<td>Balance of nature (interdependence)</td>
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<td>Nutrition</td>
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<td>Fish farming</td>
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<tr>
<td>Common animals</td>
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<tr>
<td>Wildlife &amp; national parks</td>
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<tr>
<td>Baby care</td>
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<td>TOPIC</td>
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<td>Sex education</td>
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<td>Home nursing/first aid</td>
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<td>Fire</td>
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<td>Climate</td>
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<tr>
<td>Bilharzia</td>
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<td>Building houses</td>
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<tr>
<td>Symmetry</td>
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<td>Time measurement</td>
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<tr>
<td>Simple geology; rocks &amp; minerals</td>
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<tr>
<td>Alcohol and drugs</td>
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<td>Mapping &amp; direction</td>
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<td>Sound</td>
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<td>Air</td>
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<td>Simple machines</td>
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<td>Sun</td>
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<td>Litter/rubbish</td>
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<td>Population education</td>
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<td>Human body</td>
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<td>Basic electricity</td>
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<td>Thunder &amp; lightning</td>
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<td>Natural dyes</td>
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<td>Mass</td>
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<td>Our senses</td>
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<td>TOPIC</td>
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<td>Plant growth</td>
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<td>Energy</td>
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<td>Changes</td>
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<td>Properties</td>
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When you complete this questionnaire, please return it to your head­master who in turn will see that it is forwarded to the Provincial Education Officer.

Thank you very much for your cooperation.

ENVIRONMENTAL SCIENCE
WORKING PARTY
APPENDIX C

CIRCULAR TO CONSERVATION AWARENESS
WORKSHOP PARTICIPANTS

29th June, 1977

Dear

ENVIRONMENTAL STUDIES: AFRICAN PRIMARY SCHOOLS

The Secretary for African Education has established an Environmental Curriculum Committee with the brief "to formulate and recommend ... a primary school syllabus for the new subject area, Environmental Studies." Although much daunted by the prospect, I have accepted the challenging offer to be chairman of the Committee.

One of our first and most difficult tasks will be to determine scope and purpose of such a study at the primary school level. To help the Committee in this regard, I am asking you, as a delegate to C.A.W. '77, to be kind enough to let me have a brief description of at least ONE CONCEPT you would include in the course and, again briefly, why. Please provide me with more than one concept if you feel so inclined and have the time.

The first meeting of the Environmental Curriculum Committee takes place on 14th July, so if I could have your reply before then, I would be doubly grateful, but I realize that time is short.

Thank you very much indeed.

Yours sincerely,

P. G. S. Gilbert
Director

/ms

P.S. No doubt you will be interested in the response I receive; it will be my pleasure to send you a summary.
APPENDIX D

PERSONS INTERVIEWED IN ASSESSING ENVIRONMENTAL EDUCATION NEEDS

Ministry of Education administrators and officers; frequent meetings and consultations throughout 1978:

B. Warke, Deputy Chief Education Officer, Educational Development Unit
D. Witt, Education Officer, Educational Development Unit
N. Goto, Education Officer, Educational Development Unit
J. Burmeister, Education Officer, Educational Development Unit
K. Rea, Education Officer (Special Projects), Educational Development Unit

(Also see Appendix I for teacher trainers and regional education administrators.)

Interviews and consultation with resource persons; occasionally, as required:

J. McKenna, Assistant Interpretive Officer, Department of National Parks & Wildlife
S. Laver, Research Fellow, Blair Research Laboratory
F. Middleton, Education Officer, Ministry of Health
Dr. Wilson, Geology Department, University of Rhodesia
Dr. L. A. Lister, Geology Department, University of Rhodesia
N. Puwai, Headmaster, Kudzanayi School, Highfield & National Treasurer, ZITA (Zimbabwe Teachers' Association)
F. E. Chitsike, Supervisor, Mabvuku Circuit Schools, Salisbury
G. Magadzire, Windmill Fertilizer Co., President, African Farmers Union
Les Cross & Team (Roz Heberden, Andy Crabb, Stella Wilkinson), Science Advisors, European Division, Ministry of Education
APPENDIX E

SCHOOLS IN WHICH OBSERVATIONS AND TRIAL LESSONS WERE CONDUCTED BY THE ENVIRONMENTAL SCIENCE WORKING PARTY

<table>
<thead>
<tr>
<th>Dates</th>
<th>School</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools visited for observation:</td>
<td></td>
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<tr>
<td>February 15-16</td>
<td>Mt. Marie Farm School</td>
<td>Mhondoro</td>
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<tr>
<td>April 10-14</td>
<td>Nharira</td>
<td>Harare</td>
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<tr>
<td>April 17-21</td>
<td>Chitsere</td>
<td>Harare</td>
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<tr>
<td>April 24-28</td>
<td>Chirodzo</td>
<td>Harare</td>
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<tr>
<td>May 18</td>
<td>Seki No. 2</td>
<td>Seki</td>
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<tr>
<td>Schools visited for trial lessons:</td>
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<tr>
<td>May 23-24</td>
<td>Chitsere</td>
<td>Harare</td>
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<tr>
<td>May 30-June 1</td>
<td>Gwinyai</td>
<td>Harare</td>
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<tr>
<td>June 6-8</td>
<td>Donnybrook</td>
<td>Mabvuku</td>
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<td>June 12-14</td>
<td>Kudzanayi</td>
<td>Highfield</td>
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<tr>
<td>June 13-14</td>
<td>Mabvuku Secondary</td>
<td>Mabvuku</td>
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<tr>
<td>June 20-22</td>
<td>Rugare</td>
<td>Lochinvar</td>
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<tr>
<td>June 27-29</td>
<td>Ruzivo</td>
<td>Mufakose</td>
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<tr>
<td>July 4-6</td>
<td>Chembira</td>
<td>Glen Norah</td>
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<tr>
<td>July 12-14</td>
<td>Gillingham</td>
<td>Dzivaresekwa</td>
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<tr>
<td>July 18-20</td>
<td>Salisbury Motel</td>
<td>Salisbury Motel</td>
</tr>
<tr>
<td>July 25-27</td>
<td>Chizungu</td>
<td>Epworth</td>
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<tr>
<td>August 8-9</td>
<td>Wadzanai</td>
<td>Kambuzuma</td>
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<tr>
<td>September 19-22</td>
<td>St. Aidan's</td>
<td>Seke TTL</td>
</tr>
<tr>
<td>October 2, 3, &amp; 5</td>
<td>Tomlinson Depot</td>
<td>Tomlinson Depot, Salisbury</td>
</tr>
</tbody>
</table>
APPENDIX F

CHECKLIST USED IN CLASSROOM OBSERVATIONS

A. Teacher
   1. Educational Background
   2. Experience
   3. Grasp
   4. Day to day preparation

B. Teaching Style
   1. Recitation
   2. Purposeful pupil activity
   3. Pupil questions
   4. Individuality (degree of)
   5. Differences in style
   6. Grouping (& degree of variation)
   7. Use of Shona
   8. Standard of English

C. Curriculum
   1. Reliance on syllabus
   2. Reliance on textbook
   3. Flexibility of interpretation of the time table
   4. Priorities of importance of subjects

D. Resources
   1. Broadcasting
   2. School Ground
3. Games

4. Visual Aids

5. Other

E. Evaluation

Method(s)

Teacher Questionnaire

Name_________________________ School_________________________

Subject_________________________

Grade_________________________

1. Are you using a syllabus? ______

2. Are you using a textbook? ______
   If the answer is YES, what is the name of the textbook?

3. What are your main references?______________________________

4. Which are your most useful teaching aids?_____________________

5. In helping the pupil become more knowledgeable and concerned about his environment:
   (a) what part of the syllabus or textbook do you think is least useful?
       ________________________________
   (b) why?
       ________________________________
   (c) what part of the syllabus or textbook do you think is most useful?
       ________________________________
   (d) why?
       ________________________________
(e) what else do you think could be included in this year's work that would be of value to this end?
APPENDIX G

GRADE 6 NATURE STUDY QUESTIONNAIRE

Part I

Please place a tick (✓) in the three appropriate boxes:

My position: Teacher [ ] Teacher Trainer [ ] Supervisor [ ]

Province where I work: Matabeleland South [ ] Midlands [ ]

Area in which I work: Urban [ ] Rural [ ]

A. How I use "The Outdoor World" Book 4 in my teaching of Nature Study

1. During most lessons I read the whole chapter to the children.
   Yes or No? __________ Why or why not? ___________________________

2. During most lessons I read parts of the chapter to the children and tell them about the rest of the topic.
   Yes or No? __________ Why or why not? ___________________________

3. On most occasions I read nothing from the chapter to the class and I read the chapter before the lesson and give the children my own interpretation of the topic.
   Yes or No? __________ Why or why not? ___________________________

4. Describe any other ways in which you use the textbook. Give reasons.

5. Describe in what ways (if any) do you not use the textbook, e.g., as a class reader. Give reasons.

6. Give the titles of any other books you use when teaching Nature Study to grade 6.

7. Whenever I can I (or the children) collect before the lesson several of the required living animals or plants or their parts. Then during the lesson several groups of children have one specimen each to examine.

Yes or No? __________ Why or why not? __________________________

8. On most occasions I collect before the lesson one of the required living animals or plants or their parts. Then I let each pupil see the specimen.

Yes or No? __________ Why or why not? __________________________

9. During most of my lessons I show children pictures of the required plants or animals or their parts.

Yes or No? __________ Why or why not? __________________________

10. Notes

During most of my lessons the children write some notes in their exercise books.

Yes or No? __________ Why or why not? __________________________

11. The notes children make in their exercise books are copied from the blackboard.

Yes or No? __________ Why or why not? __________________________

12. Sometimes I ask the children to invent some notes of their own to write in their books.

Yes or No? __________ Why or why not? __________________________

13. Questions

The children ask many questions during my Nature Study lessons.

Yes or No? __________ Why or why not? __________________________

Examples of questions the pupils often ask.

________________________________________________________________________

________________________________________________________________________
14. General

Describe any other things the children do during your Nature Study lessons. Give reasons.

__________________________________________________________________________

__________________________________________________________________________

15. Describe any activities which the children do not do during your lessons but which you think they ought to do or you would like them to do.

__________________________________________________________________________

C. Value of the Nature Study course for the children

16. Does "The Outdoor World" give children knowledge which will be useful to them when they leave school?

Yes or No? _________ Give examples ________________________________

17. Does the book give the children knowledge which will not be useful to them when they leave school?

Yes or No? _________ Give examples ________________________________

18. The children would like the Nature Study course to be changed.

Yes or No? _________ Why or why not? ________________________________

D. Nature Study and Me

19. The collection of plants and animals is often difficult.

Yes or No? _________ Why or why not? ________________________________

20. The lessons require a great deal of preparation.

Yes or No? _________ Why or why not? ________________________________

21. I would like to teach a different Nature Study course.

Yes or No? _________ Why or why not? ________________________________

22. Make any other comment you like about the present Nature Study course for Grade 6.

__________________________________________________________________________
Part II: Changing the Nature Study Course for Grade 6

Let us suppose the Nature Study Course for Grade 6 is to be changed. It might be broadened and called Science or Environmental Studies. Its content could be changed.

It could be changed to allow children to develop more skills and different attitudes.

A. Content

To take an example in Geography. The existing Geography course could be changed by removing Australia as a topic and including Japan as a topic.

1. List three topics you would remove from the present Nature Study course for Grade 6.
   (i)
   (ii)
   (iii)

2. State two or three new topics you would include in a much broader Nature Study or Science Course for Grade 6.
   (i)
   (ii)
   (iii)

3. For one of your topics, list about five facts or ideas you suggest children should learn about it.
   (i)
   (ii)
   (iii)
   (iv)
   (v)

B. Skills

In Geography children practice the skill of map-reading. The Geography course could be changed to include the skill of finding out "How high is a kopje or tall building?"

List some skills you think children should practice in a new Nature Study or Science Course for Grade 6.

   (i)
   (ii)
   (iii)
   (iv)
   (v)
C. **Attitudes**

In learning Geography we hope children will become curious about how other people live.

Being curious is an attitude.

List some attitudes you think should be developed by a new Nature Study or Science Course in Grade 6.

(i)
(ii)
(iii)
(iv)
(v)

D. **General**

Make any other comment you like about changing the present Nature Study course.
APPENDIX H

COMMUNITY ENVIRONMENTAL RESOURCES CHECKLIST

1. Name of Organization

2. Address

3. Person to contact:
   (a) Name
   (b) Position

4. List of possible resource materials produced by the organization

<table>
<thead>
<tr>
<th>Title</th>
<th>Date</th>
<th>Source (obtained from)</th>
<th>Cost</th>
</tr>
</thead>
</table>

5. Are speakers available to give short talks in primary schools on the work of the organization?
   Yes _____  No _____

6. Name and address to whom request for speaker may be directed.

7. List of any Environmental Study areas or places which could be made available (security permitting) for visits by pupils and/or teachers.

<table>
<thead>
<tr>
<th>Name or Description</th>
<th>Location</th>
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</table>

8. List any projects being carried out by the organization that would be of environmental interest.

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APPENDIX I

REPORT OF LIAISON MEETINGS WITH TEACHER TRainers AND EDUCATION ADMINISTRATORS

Purpose: To ascertain views of Ministry of Education representatives and teacher trainers re environmental science syllabus for primary schools.

Meetings:
1. Midlands Provincial Education representatives: 26/9/78
2. Mkoba Teachers College (2 representatives from Gwelo T.C.): 26/9/78
3. Matabeleland North and South, Provincial Education representatives: 27/9/78
4. United College of Education: 27/9/78
5. Umtali Teachers College and Manicaland Provincial Education representatives: 10/10/78

The same agenda was used for each meeting.

Attendance: See Appendix II. Teacher Trainers who attended generally had an interest in or taught subjects allied to Environmental Science.

Report on Views Expressed:

Symbols in brackets reflect degree of support by participants from all 5 meetings.

(St.) Strong support
(P.) Partial support
(Ind.) Individual view
(TCL's) supported mainly by Training College Lecturers
(Ed.R's) supported mainly by Ministry of Education representatives
1. Syllabus Content

Broad categories of content were suggested as a basis for discussion, viz:

"Natural Resources, Agriculture, Health Education and Disease, Physical Environment, Population Education, Body Systems" (see Appendix III).

Concepts and skills to be encountered within the content framework were also specified (see Appendix IV).

Views from Participants:

- The syllabus should be content (topic) based with underlying emphasis on concepts, skills. (St.)

- Content as suggested by En/Sc W.P. formed a reasonable basis for an En/Sc syllabus. (St.)

- In drawing up the syllabus scheme a concentric approach should be adopted whereby pupils first learn what is relevant in their immediate surroundings and then progress "outwards." (St.)

- Content should have relevance to pupils' lives and the national situation. (St.)

- To this end Agriculture should be an important area, especially for rural schools. (St.). Content should feature crops and issues of local relevance. (St.).

- The introduction of important cash crops from other lands should come as a follow-on to learning about local and national crops. (Ind.)

- Soil should be an important component of the syllabus. (St.)

- Even in urban areas pupils are conscious of agriculture (from rural contacts), therefore this topic has relevance in urban areas. (P.). Agriculture should be more than a practical (gardening) course. (P.).

- Schools should maintain the system of having gardens or agricultural beds/plots for flowers and vegetables. Trees should also be planted. (St.)

- Products from the garden assist in many spheres, e.g., Home Economics (Ind.), and are important in terms of the community and school status. (St.)
- A more flexible approach might be adopted whereby those teachers with the greatest motivation in gardening be allowed a freer hand. (P.)

- Y.F.C. and Agricultural advisors and their literature be used to help the headmaster plan a small family unit system where examples of different crops and small livestock can be reared and shown to be viable. A rotation system should be used. (P.)

- Pupils should progress from growing one crop in one grade to another in a different grade. Simple crops should be tackled first. (Ind.)

- Gardening difficulties encountered in rural areas include cost of fencing, inadequate or unreliable water supply, impaired tree plantations (war). (Ind.)

- Every pupil should have an opportunity of growing their own plant (or tree). A "one to one" contact should be the aim. (P.)

- The syllabus should specifically include topics such as "how nature works" (simple ecology) and "how nature is unbalanced" (pollution, overbreeding, etc.). (Ind.)

- Sex education is a sensitive and controversial issue (St.). It should be taught under the umbrella of another topic (P.). It should be taught by "outsiders," i.e., skilled persons such as the health advisor or nurse (P.). It should first be introduced on a trial basis in a few schools (P.).

- Sexually transmitted diseases need to be included. (Ind.)

- The parents' views on sex education are paramount. (P.)

- Climate must not be taught in isolation but in relation to food, clothes, disease, etc. (Ind.) A better terminology would be "weather." (Ind.)

- Population Education should not be a separate topic, but rather embodied within many other topics. (P.)

- Direction finding and map making are important skills and concepts to master. (St.)

- Other additions suggested for content: fertility trenches, disused mine hazards. (Ind.)
Additions were suggested for the lists of skills and concepts. 

*Example*: concepts: cause and effect, probability 

*Example*: skills: choosing, estimating, modeling, selecting a tool, 

*Example*: e.g., measuring device. (P.)

2. Methods and Strategy

Possible approaches and teaching methods for Environmental Science were presented. See Appendix V.

**Views from Participants:**

- The accepted trend is to move away from teacher dominated chalk and talk to more pupil/group centered activity. However, in practice teacher talking, traditional methods, copying from the blackboard, answering questions posed by the teacher is still very much the order of the day. (St.)

- Supervisors generally judge the quality of work by the quality of pupils' notebooks, while recommending self expression. (P.)

- There used to be an insistence on "complete sentence" answers from pupils. This is now less emphasized especially in non-language lessons. (P.)

- Evaluation exercises frequently involve pupils filling blank works. This is often inadequate. (P.)

- Current emphasis is on pupils sitting and working in groups. These may be mixed ability or "streamed" groups within a class. Decision up to headmaster.

- There is danger that each group merely replicates a class situation in which the group leader (and his favorite) dominate and do most of the communicating. (St.)

- There is a need for different standards and expectations to be applied to different ability groups. (Ind.)

- Group size should vary with activity. (P.)

- It is desirable to have varied activities, some for whole class, some for groups and some for individual pupils. (Ind.)

- The approach should be to encourage pupils to use activities with as little teacher interference as possible. To ensure end results accountability must be built into approach. (T.C.L.'s)

- Pupils must be encouraged to ask more questions. (P.)
- A danger in above, pupils' questions can get too wide and off the point. (Ind.)

- Problem solving approaches be used (Ind.) and (T.C.L.'s)

- If "pupil drawing" method used then consideration must be given to shortage of paper, problems of pictoral and scale perception by pupils and motivation of teacher. (Ind.)

- Science corners are poorly used ("incredible rubbish"). (P.)

- Length of lessons is too rigid. Needs to be more flexible especially if visits, activities, projects to be included. (P.)

- Project approach depends on teacher experience, projects need to be well selected by teacher, simple and suited to ability, time and resources. (P.)

- Allow pupils to assess each other's project. (Ind.)

- Group activity is one way of coping with lack of material resources. (P.)

Additional Approaches Suggested by Participants:

- Nature/urban trails—a form of programmed learning. (T.C.L.'s)

- Making of mobiles.

- Dioramas—displays in 3 dimensions, e.g., in a corner (as in museums).

- Puppet making with handkerchief and hand—an extension of role playing. (Ind.)

3. Resources

Accessibility of resources by pupils and teachers is an obvious problem.

Views of Participants:

- Written, pictorial and A.V. resource material for the classroom is very limited. (St.)

- The establishment of a "resource room" in each school is desirable and would help to overcome theft problems. (P.)

- Teachers should have reference books as well as text books. (P.)
- It is probable that teachers will buy more of their own books especially those who are now better paid. (T.C.L.'s)

- There should be a specific resource book giving factual information to cover the proposed syllabus. (Ind.)

- Teachers' Forum Supplement is a possible venue for resource material. (Ind.)

- There should be an "A to Z" Resource book about Environmental Science relevant to syllabus. (Ind.)

4. Teacher & Supervisor Orientation

The introduction of yet another new syllabus with stress on non-traditional approaches will bring resistance.

Views of Participants:

- Fear exists that teachers will not be able to meet requirements of new En./Sc. syllabus. (Ind.)

- Need for in-service training to help teachers to meet new demands. (St.)

- In certain instances new teachers have to adopt "traditional ways" of some headmasters for job security. (Higher pay of new teachers creates further difficulties in relationships.)

- Teacher Training Colleges must be put in the picture as rapidly as possible re new En/Studies syllabus. At present they are working in a vacuum. Need and desire to coordinate efforts. (T.C.L.'s)

- The best incentive to change is to use the desire of teacher to get a good assessment by supervisor and headmaster. (Ind.)

Other Incentives to Change:

- Reward innovative work by asking teacher to demonstrate and display their work to others. (Ed.R's)

- Ask better teachers to lead discussions at teachers' courses/ seminar. (Ed.R's).

- New methods adopted to secure jobs. (Ed.R's)

- New methods adopted to achieve promotion, e.g., placed in charge of certain class groupings. (Promotion is a greater incentive than pay increase although the two are obviously linked.) (Ed.R's)
5. Participation by Teachers, Supervisors, & Training Colleges in Design of New Material

To what extent would teachers be prepared to help in curriculum development? Would lecturers like their 3rd year students to become involved?

- Gwelo T.C. (P. Taylor) will produce a statement on concepts, skills, and content that should have been acquired by pupils entering secondary school. (Ind.)

- Prepared to give En./Sc. content suggestions to students for them to select a topic and develop a series of lessons. 1978--Mkoba (St.) 1979--U.C.E. (Ind.) and UTTC (St.)

- Students to try out lesson units developed by En./Sc.W.P. and give feedback. (T.C.L.'s-P.)

A group of Manicaland teachers (Miss Mutendadzamera and Messrs. Chitakatira, Marira, Garura) with the assistance of supervisor Mr. Makurumidze and E. O. Mr. S. Kuwana had prepared an Environmental Studies syllabus for Grades 1 to 7. The content of this was broadly in accord with En./Sc. W.P. suggestions; however, in some instances the level of sophistication envisaged was high, e.g., osmosis and transpiration (Grade 7).

6. New Resource Texts

How would participants like the content and approaches in new syllabus presented?

Views of Participants:

- A teacher's resource book is seen as imperative. (St.)

- Money is the limiting factor in terms of a text book for pupils, desirable as this might be. (P.)

- Material should not be presented in a highly structured form. This is "doing everything" for the teachers, destroys initiative, soon gets out of date, promotes boredom. (St.) Especially (T.C.L.'s)

- Material should be presented in a highly structured way so as to make older, more traditional teachers use new approaches. (P.) and some (Ed.R's)
Acknowledged that highly structured approach can lead to teacher going through the motions without knowing purpose. If on other hand teacher had to design own lesson this would be avoided. (St.)

Format should be suggestive rather than prescriptive. (St.)

Instead of "lesson steps" use "suggested steps." (Ind.)

Material should include "Behavioral objectives." (St.)

Format should give resource material only. Let teacher develop own lesson plan entirely. (Ind.)

Format should give topic, objectives, references (resource information), and suggested alternative activities. (Ind.)

Format should give topic, sub-topic, purpose of lesson unit, knowledge to be acquired, skills to be acquired, resources. (Ind.)

Topic be presented with a "model." Strong suggestion that teacher should vary this according to needs of class and environment. (P.)

Possibly have an unstructured scheme for enlightened teacher and structured one for weaker teachers. (Ind.)

Present "unit/topic" plans rather than "lesson" plans. (Ind.)

List a variety of activities for each lesson or topic including things that can be done in the classroom and outside the classroom. (St.)

Syllabus should be presented in spiral manner whereby simple concepts in early grades are returned to in higher grades and built upon. (Ind.)

The written material should not be too long or detailed. There is a limit to what teachers will read. (Ind.)

S. Parker
I. Allen
C. Chimombe

En. Sc. Working Party
October 1978
Appendix I to the Liaison Meetings' Report

Liaison Meetings with Ministry of Education Officers/Training College Staff and Environmental Science Working Party: Agenda

Introduction: Background leading to establishment of working parties.

1. Suggestions for Syllabus Content
   a) Tentative ideas
   b) Concepts and skills
   c) Questionnaire No. 2
   d) Discussion; views of those present.

2. Methods and Strategy
   a) Approaches tried: examples of lessons

   For discussion:

   b) What methods of teaching and testing are most commonly used in primary schools at present?
   c) What methods are being advocated?
   d) Where does emphasis lie in classroom management? in teaching class as a whole? in group work? in individual learning approach?
   e) What emphasis is placed on the quality of recording in pupil notebooks?
   f) Should project work feature more?
   g) Do pupils need more practice in questioning?

3. Resources
   a) Access of teachers and pupils to written information.
   b) Access to other materials.

4. Teacher and Supervisor Orientation
   a) What is the greatest incentive to change? Promotion? Praise? Popularity? Pay?
   b) In-service and pre-service courses.

5. Participation by Teachers, Supervisors, and Training Colleges in Design of New Material
   a) Would teachers be prepared/like to help?
   b) Could Training College students become involved?

6. New Resource Texts
   For teacher, for pupil, for both? Style? Format?
## Appendix II to the Liaison Meetings' Report

### List of persons present at liaison meetings

<table>
<thead>
<tr>
<th>Name</th>
<th>Province</th>
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<tbody>
<tr>
<td><strong>Midlands P.E.O. Meeting: 26th September, 1978:</strong></td>
<td></td>
</tr>
<tr>
<td>Mrs. R. Begley</td>
<td>Educ. Officer, Home Economics, Midlands Area</td>
</tr>
<tr>
<td>M. B. Poyah</td>
<td>Educ. Officer, Midlands</td>
</tr>
<tr>
<td>B. M. Wakatama</td>
<td>Supervisor, Gwelo/Selukwe</td>
</tr>
<tr>
<td>G. N. S. Kumalo</td>
<td>E. O. Gwelo North, Midlands</td>
</tr>
<tr>
<td>N. M. Mashingaidze</td>
<td>E. O. Gwelo East, Midlands</td>
</tr>
<tr>
<td><strong>Mkoba Meeting: 26th September, 1978:</strong></td>
<td></td>
</tr>
<tr>
<td>Jannie Makawa</td>
<td>Lecturer in E/S, G.T.C.</td>
</tr>
<tr>
<td>S. M. Sithole</td>
<td>Lecturer in En. Stds., M.T.C.</td>
</tr>
<tr>
<td>R. F. M. Beaver</td>
<td>Senior Lecturer, M.T.C., En. Std.</td>
</tr>
<tr>
<td>S. E. Zhou</td>
<td>Senior Lecturer, M.T.C.</td>
</tr>
<tr>
<td>P. K. Taylor</td>
<td>Senior Lecturer, En. Std., G.T.C.</td>
</tr>
<tr>
<td>E. S. Hwata</td>
<td>Senior Lecturer, M.T.C.</td>
</tr>
<tr>
<td>L. Chaduka</td>
<td>Teacher, M.T.C.</td>
</tr>
<tr>
<td>A. Machakaire</td>
<td>Tutor, M.T.C.</td>
</tr>
<tr>
<td>E. T. Papaya</td>
<td>Lecturer, Science, M.T.C.</td>
</tr>
<tr>
<td><strong>Bulawayo P.E.O. Meeting: Matabeleland North &amp; South: 27th September, 1978:</strong></td>
<td></td>
</tr>
<tr>
<td>M. Major</td>
<td>E.O. Gwanda, Mat. South</td>
</tr>
<tr>
<td>I. M. Causland</td>
<td>E.O. Geog. &amp; E.S., Byo. Sec. Schools E.O.</td>
</tr>
<tr>
<td>S. M. Hadebe</td>
<td>E.O. Nkai, Mat. North</td>
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<tr>
<td>D. B. Glassbrook</td>
<td>E.O. Byo., Mat. North</td>
</tr>
<tr>
<td>J. P. Hancocks</td>
<td>E.O. Matobo, Mat. South</td>
</tr>
<tr>
<td>S. Wilkinson</td>
<td>Teacher, attached to R.E.O., Byo.</td>
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<tr>
<td>Z. Z. Thodlana</td>
<td>Supervisor, Mat. North</td>
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<tr>
<td>W.N. Mkumbuzi</td>
<td>Supervisor, Mat. South</td>
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<tr>
<td>B. G. Mpopfu</td>
<td>Deputy Headmaster, Mat. North</td>
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<tr>
<td>D. M. Dube</td>
<td>Headmaster, Mat. North</td>
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<tr>
<td>C. M. Masuku</td>
<td>Headmaster, Mat. North</td>
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<tr>
<td>I. N. Mpopfu</td>
<td>E.O. Nyamandhlovu, Mat. North</td>
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<tr>
<td>T. E. Owen</td>
<td>P.E.O. Mat. South</td>
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<tr>
<td><strong>Bulawayo U.C.E. Meeting with Teacher Trainers: 27th September, 1978:</strong></td>
<td></td>
</tr>
<tr>
<td>N. Sibanda</td>
<td>Tutor in History &amp; Environmental Studies</td>
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<tr>
<td>N. Mdawarima</td>
<td>Tutor in Religious Studies, main subject</td>
</tr>
<tr>
<td>S. Mlambo</td>
<td>Tutor in Math &amp; Geography</td>
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<tr>
<td>Name</td>
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<tr>
<td>M. E. W. Noube</td>
<td>Tutor in Environmental Studies &amp; Physical Ed.</td>
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<tr>
<td>J. Ncube</td>
<td>Science/E/S</td>
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<tr>
<td>R. M. D. Mapungwana</td>
<td>Tutor &amp; Coordinator on Environmental Studies</td>
</tr>
<tr>
<td>P. Desai</td>
<td>Tutor, Physical Education</td>
</tr>
<tr>
<td>P. M. Payne</td>
<td>Deputy Principal (Professional)</td>
</tr>
</tbody>
</table>

Manicaland Province Meeting (E.O.'s, H.M.'s, T.'s & T.T.'s): 10th October, 1978:

- E. N. Tsododo: Teacher, Sheni Gov. P. School
- E. Chiripanhuru: Teacher, Sakubva Primary
- H. Marira: Teacher, Dangare Primary
- Eben Kawadza: E.O. Manicaland Province
- M. Kudzunga: Teacher, Zimunya
- M. Juma: Teacher, Mutanda
- Z. S. Garura: Teacher, Zamba
- C. Chitakatira: Teacher, Rujeko Primary
- A. M. R. Chingowa: Supervisor, Ministry
- T. T. Makurumidze: Supervisor
- G. Rondozai: Supervisor, Umtali No. European Area
- T. Madziyanyika: Supervisor
- E. Mutendadzameia: Teacher, Chisamba Gov. School
- D. Sithole: Supervisor
- A. J. Rushwaya: Tutor, Umtali Teachers College
- S. M. L. Kuwana: E.O., Ministry
- J. Lyons: T.T., U.T.T.C.

Appendix III to the Liaison Meetings' Report

Some content suggestions:

I. Natural Resources


II. Agriculture

Crops, Livestock (including small livestock, e.g., poultry, rabbits), Land Management, Irrigation, Contours, Terracing, Food Pests, Storage of Crops, Plant and Animal Products.
III. Health Education and Disease

Personal hygiene, toilets, nutrition (diet, malnutrition, kwashiorcor, marasmus). Disease (disease carriers, measles, common flu, gastro-enteritis, bilharzia, malaria, cholera, etc.), Immunization, First Aid, Healing, Child Care.

IV. The Physical Environment

Land forms (hills, rivers, planes, dams), Climate (seasonal changes, thunder and lightning), Simple Machines, human hand, wheel--oxcarts, bicycles, motor cycles, cars, lorries, buses, roads, bridges.

V. Population Education

VI. Systems in the Body

For moving, for getting energy from food, for making more people, for removing waste matter, for moving things around the body.

Appendix IV to the Liaison Meetings' Report

Concepts and skills to be arrived at through content experience:

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Skills</th>
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<tbody>
<tr>
<td>mass</td>
<td>measuring</td>
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<td>volume</td>
<td>observing</td>
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<tr>
<td>energy</td>
<td>classifying &amp; sorting</td>
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<tr>
<td>growth</td>
<td>recording</td>
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<tr>
<td>conservation</td>
<td>collecting</td>
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<td>matter</td>
<td>experimenting</td>
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<td>changes</td>
<td>comparing</td>
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<td>cycles</td>
<td>communicating</td>
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<td>scale and size</td>
<td>detecting</td>
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<td>body systems</td>
<td>questioning</td>
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<td>fuel</td>
<td>role playing</td>
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<tr>
<td>natural resources</td>
<td>simplifying</td>
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<tr>
<td>inter-dependence</td>
<td>manipulating</td>
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<td>input and output</td>
<td>problem solving</td>
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<td>decay</td>
<td>drawing</td>
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Appendix V to the Liaison Meetings' Report

Methods & strategy: possible approaches:

1. Cards with questions—for discussion by pupils within a group.
2. Reporting by a member of a group to other groups.
3. Tummy-stick figures to make drawing by teachers and pupils easy and fun. Use a set "family" throughout?
4. Action drawings--draw together, teach, add to drawing, e.g., dress up tummy-stick figure with animal products.
5. Flow diagrams--information in point form in block or bubble, arrow to further unit of information.
6. Cross section diagrams in one plane.
7. Hook-ups--main idea in center, sub-concepts or allied ideas hooked onto it.
8. Label making by pupils to summarize information on diagram or chart.
9. Use of outdoors and school grounds--for observation, finding out, collecting, and recording information, etc.
10. Short visits to nearby areas, e.g., market, vlei, stream, etc.
11. Games--quick games and long-term games.
12. Role playing.
13. Chart making--in groups.
14. Collecting information by survey, e.g., asking people,
15. Personification, e.g., what is the plant saying?
16. Singing, e.g., to reinforce a concept.
17. Story telling.
18. Charts which are built up, e.g., Bilharzia cycle.
19. Using models, e.g., small mound to represent real hill.
21. Describing by writing.

22. Recording in tables, charts, histograms, etc.

23. Cards with tasks—for individual work.
it is very bad to grow your crops on a slope hill because they will washed away by the rains. A wise farmer will build some terraces to protect the floods from destroying his crops.

A farmer should have a field on a plain land. It is very good to have a field on a level ground because leaf moulds and farm manure are put and are not washed by the floods.

If you grow crops on a slopping hill side, they will quickly be taken away by the floods and also damaged by the rolling stones that will break into sand.

To defend your crop from danger you must dig some contour ridges. If you do not dig contour ridges there will be soil erosion.

Figure J.1. Example 1 of Evaluation Exercise on Unit on Soil Formation and Soil Erosion, Grade 5
It's bad to grow crops on the slopes of a hill because the water running down the hill would be very powerful and all the soil would be cleared away.

We should grow them on a flat land because the water would flow everywhere very slowly. No soil erosion would be caused anymore.

Also that the leaves coming down the hill would be carried down into the flat land. The land will now be very fertile. People will grow fine crops and have good harvest.

Figure J.2. Example 2 of Evaluation Exercise on Unit on Soil Formation and Soil Erosion, Grade 5
A good man puts rubbish in these places:

I see worms
I smell bad
I feel sick
Rubbish is something that is thrown away because it is not wanted.

I found rubbish in the rubbish van, in the rubbish bin, on the road and in the field.

Figure J.4. Example 2 of Evaluation Exercise on Unit on Rubbish, Grade 3
Rubbish lying around

1. It is dirty.
2. It can attract flies, rats, dogs.
3. It can cut us.
4. It smells bad.

We must put rubbish here.

Covered bin  hole in the ground  Compost pile

Figure J.5. Example 3 of Evaluation Exercise on Unit on Rubbish, Grade 3
Figure J.6. Example 1 of Evaluation Exercise on Unit on Trees, Grade 4
(1) The three names of trees are: Singa, Jacaranda, uMtswiri.

(2) a) Birds make nests up on the trees.
   b) Animals stand under the shades of trees.
   c) Animals eat the leaves of the trees.
   d) Birds eat flower juices.

(3) I would prevent people from cutting down trees and branches for any reason.
   I would let shoots grow out of the stumps.
   I would plant more trees if there are no trees.

Figure J.7. Example 2 of Evaluation Exercise on Unit on Trees, Grade 4
1. The names of the three trees which are commonly found around the school area are gum tree, banana tree, and Mulayamhando tree.

2. Animals and birds use tree leaves for shade.

3. I would start a project to save trees. People would not cut the trees. I will tell them not to cut the trees.

Maria Sengweni
31st October, 1973

Science

1. Musasa tree, muchakata tree, musvita tree.

2. Birds make their nests in the trees. Animals rest under the trees' shade. Birds eat the trees' flowers and fruits. Animals eat the leaves of the trees.

3. If we want to save trees in our school area we can make a Gum tree plantation. When we want to use the gum trees we can go and cut a few of them.

Figure J.8. Example 3 of Evaluation Exercise on Unit on Trees, Grade 4
Stephen 3A

Science

Water is colourless.
Water is a liquid.
Water has no shape.

Clean ears
Clean hair
Clean ears
Clean teeth
Clean clothes

Clean body

Figure J.9. Example 1 of Evaluation Exercise on Unit on Water, Grade 3
Tuesday 14th November 1979
Science Test

Water

✓ It is tasteless.
✓ It has no colour.
✓ It is liquid.

1. Washing face with water
2. Cleaning teeth with water
3. Drinking water

Figure J.10. Example 2 of Evaluation Exercise on Unit on Water, Grade 3
Figure J.11. Example 1 of Evaluation Exercise on Unit on Plant Roots
Need Soil, Grade 5
Figure J.12. Example 2 of Evaluation Exercise on Unit on Plant Roots
Need Soil, Grade 5
APPENDIX K

TEACHER GENERAL QUESTIONNAIRE THAT ACCOMPANIED EACH UNIT
OF LESSONS FOR TEACHER CONDUCTED CLASSROOM TRIALS

Please fill in and return to us via your headmaster.

Teacher's Name ___________________________ Grade ___________________________

Name of School _____________________________

Urban or Rural ________________________________

Please note, these questions are not to test your teaching but rather how successful our lessons are. Please answer honestly.

Part One

<table>
<thead>
<tr>
<th>Lesson 1</th>
<th>Lesson 2</th>
<th>Lesson 3</th>
<th>Lesson 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dates on which lessons were taught, e.g., 7/10/78</td>
<td></td>
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<tr>
<td>2. Minutes of class time spent on each lesson</td>
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<tr>
<td>3. Pupil interest: Place one tick on each line to indicate what portion of the class showed:</td>
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<td></td>
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<tr>
<td>None</td>
<td>Up to 1/4</td>
<td>1/2</td>
<td>3/4</td>
</tr>
<tr>
<td>High interest</td>
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<tr>
<td>Moderate interest or indifference</td>
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<tr>
<td>Resistance or dislike</td>
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</table>

In the following questions please use a ✓ or X where appropriate.

4. Materials required:  ✓ Easy to get,   ✓ Hard to get,   ✓ Unobtainable
Which materials were hard to get or unobtainable?

5. The lessons were: ___ Too easy, ___ Too difficult, ___ All right.

6. What were new words for Pupils? Give examples.

7. Did pupils have difficulty in understanding any of these words? ___ Yes ___ No

8. Were instructions to teacher clear?
Comment.

9. Will the knowledge gained from these lessons be something that will help pupils in everyday life? ___ Yes ___ No

10. Did you omit any parts of these lessons? ___ Yes ___ No
Reasons?

11. Your rating of these lessons:
___ Worthwhile keep as it is.
___ Of value but needs revision.
___ Worthless do not use.

If revision is needed, what do you suggest?
12. Did pupils achieve the behavioral objectives of the lessons?
   ___Yes    ___No

   Please comment on results of the test or evaluation exercise here:

   _____________________________________________
   _____________________________________________

13. Any other comments:

   _____________________________________________
   _____________________________________________
APPENDIX L

UNIT ON WILDLIFE INCLUDING TEACHER'S QUESTIONNAIRE

**Topic:** Natural Resources

**Sub-Topic:** Wildlife and National Parks

**Grade:** 5 or 6

**Lesson I**

**Purpose of Lesson:**

To introduce the idea of:

i) the present immediate surroundings being different 100 years ago;

ii) some properties of wild animals.

**Preparation:**

Materials needed: resource sheets depicting pictures and drawings, each of a particular wild animal.

**Lesson Steps:**

1. Take pupils back in time to 100 years ago. Use reference points such as pupils' ages, parents' ages, grandparents' ages. Can they think of a time before their grandparents were born?

2. Go outside and help pupils to visualize the surroundings as they would have been 100 years ago. Would the school building have been there? Would the existing trees, rocks, grass, etc.? What would the vegetation have been like? Would man have been there? Yes--a few people. What animals? Introduce the idea of wild animals living in the area.

3. List a number of wild animals (about 8, selected from the resource sheets) on the board. Divide the class into groups (about 5 per group) to investigate these animals.
4. Give groups the resource sheets and questions (one or two per group). Let pupils discuss each question in turn as a group and, using the resource pictures, find out the answers. Pupils must not "imagine" the answers. Let each pupil write the answer in their book.

5. Reporting: A representative from each group talks to the class about their animal. Try to let other pupils see pictures of the animal that is being reported on. Perhaps some of the resource sheets could be put up on the classroom walls.

Behavioral Objectives:

Pupils will be able to:

i) describe how the school surroundings might have been 100 years ago;
ii) interpret the pictorial resource material so as to be able to answer the questions posed, both in writing and verbally.

Lesson II

Repeat lesson steps 3, 4, and 5 of previous lesson so that groups have the opportunity to find out about a few other animals.

Lesson III

Purpose of Lesson:

i) To establish that different animals eat different things—these can be grouped into categories;
ii) To establish that animals use different places for different things.

Lesson Steps:

1. Make a table on board to show how animals in previous lesson feed on different things, e.g., meat, grass, leaves. Let pupils participate by writing animal names or putting ticks in columns, etc. Instead of a table you might like to try a more informal, quicker method, e.g.,
2. Make a similar system for showing that animals use different places for different things.

Trees:

- for hiding and eating
- for sitting in
- for shade

- giraffe
- vultures, leopard
- rhino, impala, lion, cheetah, etc.

Rocks:

- for shelter
- for lying on & getting sun

- dassies, lion, cheetah
- dassies

Grass:

- for walking through
- for hunting in
- for eating

- lion
- cheetah
- zebra, rhinoceros

Extra Points:

Try to use this lesson to reinforce the behavior and habits of animals.

Behavioral Objectives:

1. Pupils will be able to sort animals into different eating categories.
2. Pupils will be able to answer the following questions:

   a) In what ways do animals use rocks?
   b) In what ways do animals use grass?
   c) In what ways do animals use trees?

3. Pupils will be able to give an example of animals that use rocks, grass, and trees in different ways.

Lesson IV

Purpose of Lesson:

To provide pupils with an experience of making maps with animal trails.

Preparation:

Materials needed for each group:

   i) A sheet of paper (newsprint or double page from exercise book);
   ii) A felt pen if possible;
   iii) A few small stones, round shaped leaves, e.g., geranium leaves, a lid from jam jars, etc., piece of string about 15 cm long.

Materials needed by teacher for demonstration:

   the above, plus a few leafy twigs (about 10 cm tall), lump of clay or plasticine.

Lesson Steps:

I. Demonstration of Map Making

1. Demonstrate how to make a map of an object by looking down from the top. Let pupils look at an object (e.g., each other, a bottle) sideways and then from above. Draw the top view.

2. Take a leafy twig, anchor its stem in plasticine or clay. Stand it on a big piece of paper and ask how it appears from the top. Take a long pen and draw around the edge of the leafy top (roughly).

3. Explain it would be easier to do this if the stem were removed. Replace the twig with a rounded, irregular leaf (which looks something like a tree from above), remove the leaf stalk and place flat on the paper. Draw around the leaf edge. This will now represent a tree.
4. Draw around a little pile of stones—let this represent a rocky place or kopje. Stripe in this area to distinguish it from the "tree" symbols.

5. Draw around a lid which contains a little water. This represents a place where water is (e.g., water hole). Use wavy lines to represent the symbol for water.

6. Draw short strokes to represent grassy areas.

7. Place a ruler on the map, draw a line 15 cm long and say that this will represent 1 km. Cut a piece of string the same length as the line to represent 1 km. (You might like to change this scale according to whichever animal is being used.)

8. Make a key to the side of the paper. This must say what the symbols used mean, e.g.,

   **Key:**

   - grass
   - tree
   - rocks
   - water

9. Make an animal trail to show what an animal (e.g., lion) might do during a day. Make crosses to show the position of the animal(s) at various stages. Write in the time of day at which the animal is at various places. Make arrows on the trail line to show direction.

   The map might look something like this: (please see next page)
MAP SHOWING LION TRAIL.

Start 5 a.m.

6 a.m.

7 p.m.

9 a.m.

10 a.m.

Key:
- grass
- trees
- rocks
- water

SCALE: 1 km
It is important not to introduce sideview drawings (e.g., picture of animal, sideview of hill or anthorn), when learning about maps. All maps are made as though the viewer was high in the sky looking down from the top. Introduce any other features that may be suggested, e.g., anthill, river, etc. Remember, too, that animals never walk in straight lines. Why?

10. Ask questions about the map and help pupils to find out how to answer them, e.g.,

   i) How far did the lion travel in one day? (use string).
   ii) How long did it rest after the kill?
   iii) How many times did it go to drink water?

11. Let pupils in groups practice making their own map and animal trail. Suggest that the map must "tell a story." It must also be a map which shows us how a certain animal behaves, where it goes for shelter, shade, rest. What sort of food it eats. At this stage it is probably better to deal only with one kind of animal. If, however, pupils want to show that an impala smelled danger (a cheetah?) and then ran away from that place, this could be shown by, e.g.:

![Diagram](image)

Behavioral Objectives:

   i) Pupils will be able to construct a map which shows physical top view features of a place and an animal trail.

   ii) Pupils should be able to use string and a scale to measure how far the animal travelled.
Lesson V

Purpose of Lesson:
To provide further experience in making and interpreting maps.

Preparation:
As for Lesson IV.

Lesson Steps:
1. Let pupils make maps as practiced in previous lesson.
2. Pin maps on wall. Let one group spokesman explain what their map means to the class.
3. Let one group visit another group's map and say what they think this map means, i.e., interpret the map without guidance from those who made it.

Extra Points:
If the activity arouses interest and enthusiasm, you might like to make a big class map (as a frieze along one wall?). The physical top-view features could be drawn on to this. Then groups in turn could draw in trails for their animal. One might get some interesting interactions between animals!

Behavioral Objective:
Pupils will be able to make and interpret maps.

Lesson VI

Purpose of Lesson:
To establish a positive attitude toward National Parks.

Materials Needed:
A map of Rhodesia which shows the larger National Parks. (Color in National Parks beforehand.)
Lesson Steps:

Tell the story: *Wild Animals and the Problem Animal*, by J. Makina, Part I. (During the story have pupils sit in their animal groups. Each time their name, e.g., "elephant" is mentioned they must do something to represent that animal, e.g., make a noise like the animal, wave their trunk or ears, show their claws, etc. Try to get pupils involved. Please adapt the story to include all the animals pupils have been learning about.) If possible tell the story, do not read it. Adapt it as you please.

Imagine yourself in a land very far away. Now, once upon a time, in this land there were many animals. There were also many birds, snakes, insects, trees, and grass. Let me tell you some of the animals that lived there.

There were elephants, lions, hyenas, zebras, impala, vultures, cheetahs, rhinos, giraffe, dassies, leopard, buffalo, and many others. All these animals lived very happily together.

There was a lot of food too. Grass for the zebras, impalas, wildebeest, elephants, and rhinos. Meat for the leopards, cheetas and lions, and leaves for the giraffe, eland, and elephant.

When some of the animals got sick or grew old, they died and there was also lots of food for vultures, hyenas, and jackals. Vultures and hyenas also ate meat from animals that the lions and cheetahs killed.

There were large open vleis for zebras and wildebeest to play in. Rhinos and buffalo played in the mud, whilst crocodiles and hippos warmed themselves on the sunny sand banks of the rivers.

The animals had a king—the lion. He was a very big and respected king. He had his councillors too—Zizi the owl, Hamba the tortoise, and Shato the python. Together they ruled wisely and everything was quiet and peaceful.

One day a new strange animal arrived in the land. This new animal had no feathers or hair or fur. He walked on two legs! Do you know the name of this animal? Yes, man.

When man came, he went to King Lion to ask if he could live on the land. King Lion agreed, but his councillors did not.

"He looks too clever" said owl. "I don't like his looks," he added.

"Won't he finish our food?" asked python.

"I am afraid he may have too many children" said tortoise, "and he will take our land from us."
classies

elephant group pretending to wave their trunks + flap their arms

Impala
"Well," said Lion, "if he has too many children, I will eat them. They will make very good dinner. I will let him stay on our land."

So man and his friends and relatives stayed on the land.

Now, man was a very strange animal. He did not live in caves like leopard or lion, neither did he live in trees like baboon or monkey. He did not live in the grass like python. Instead he made his own home. To do this he cleared the bush and cut down a lot of trees.

Man also had strange eating habits. He did not live on roots or wild fruit and berries only. Instead, he cleared more bush to grow his own fruit, berries, and seeds.

This strange animal, man, also ate meat. He hunted and killed like the lion, leopard, cheetah, or hyena, but he killed more animals than he really ate. Sometimes he just killed to get the horns, or the skin or meat. Man was surely a very strange animal.

Man and his relatives had very few animals that killed and ate them, therefore they multiplied until they were very very many.

When they cut more trees and burnt more bush, birds had nowhere to sleep or build their nests. Elephant and giraffe became short of food from trees. Impala, zebra, wildebeest and rhino had very little grass left to eat.

All the animals became very unhappy. They no longer could eat where they liked or do as they pleased. Their neighbor, man, was a greedy animal and wanted everything to himself.

Soon the animals began to complain to their King. First came kudu and Impala.

"Oh King" they said, "we have a problem. This new neighbor, man, who you allowed to settle on our land, is too greedy and cruel. He has many wasteful habits too. He burns all the grass and now we have nothing to eat. He is also killing us just for our horns!"

"What do you want me to do?" asked Lion.

"Kill him. You are the King. After all, you let him settle on our land," answered kudu and impala together.

"Alright, I will see what I can do," answered King Lion.

The Kudu and Impala went away mumbling to themselves.
Early next morning when King Lion was about to have his food, Giraffe and Elephant came marching in.

"Our food is gone and we are hungry," they said.

"Your food is gone!" exclaimed the king. "Where to?" he asked.

"Man has taken it all," said Giraffe angrily. "Yes, that animal you allowed to settle on our land is a very bad animal," added elephant.

"But I do not understand," said Lion.

"You see," said giraffe, "he is chopping down trees for his firewood and to use as poles for his hut and planks for his furniture. Now we have very little food left to eat."

"What do you want me to do?" asked Lion. "Why don't you tell him to stop?"

"We can't," answered giraffe. "He kills us with his gun. You can kill him--after all, you are the King."

"Alright, I see the problem. Go away but do not worry. I will think about it," answered King Lion.

"Of course we will worry," retorted elephant.

"I wish he was in our hooves," added giraffe as they left King Lion's court.

A week passed by without King Lion receiving any complaints. Then one afternoon when he was about to have his dinner, Hyena and Wilddog came racing in and making a terrible noise.

"Hoo wee! I'm hungry! There is no meat in the vlei, not even bones!" shouted Hyena.

"You will have to give us some of your food," added Wilddog who was already taking Lion's dinner.

"Yes! Yes!" came in hyena. "You can't eat alone while we starve," and he snatched a piece off Lion's mouth.

"Grr!" roared Lion and he was very, very angry. "You can't do that. You should respect your King!"

"Respect? Not when we are starving," said hyena with a mouthful of meat from King Lion's dinner.
As they were quarrelling and arguing with each other, vulture and his friends flew in and began to help themselves to the dinner.

When hyena and his friends had gone, Lion asked his councillors what he should do.

"Call everybody to a meeting and then we can discuss the problem together," tortoise said.

"Yes, that's right" said Lion. "Sent Tsuro the messenger to everybody," he ordered.

The following day everybody came to the meeting. They sat in their places under a big Muhacha tree. The birds perched themselves in a nearby Muzhange tree.

When Tsuro had ordered everybody to be silent, King Lion spoke.

"A few weeks ago impala and kudu came to tell me of what our friend man is doing. Elephant and giraffe also came with the same story. Hyena and his friend wild dog were very impolite to me, their king, when they came to tell me of our friend Man. Now what shall we do?"

"He is no longer our friend" barked baboon who was sitting cross-legged on a large rock.

"It seems to me," said lion "that we have a big problem. This man-animal is causing trouble. Tsuro what do you think we should do?"

There was lots of shouting while Tsuro was silent thinking. Many animals mumbled "kill him," "send him away." Finally Tsuro said "Let us all go away and discuss this problem and think of a way to answer the problem."

End Part One

2. At the end of part one, let pupils in their animal groups each discuss the problem—from the animal's point of view, and then report back to "Lion."

3. The Story Part II (continued):

Lion and his councillors listened patiently to all that the animals had to say. However, there seemed to be no solution. Man had guns, he was clever, if the animals were to try and kill him, they no doubt themselves would be hunted and shot even more than they were at present.

Finally Tortoise made a suggestion.
"Why don't you call man here and we will ask him questions and explain the problem. Let us see what he says."

All the animals agreed and man was called. He was given the problem. He took a long time to think about it and to see if his many relatives could agree. At last he said,

"I see that we have a real big problem. But I think there is a way of solving it. I think we should divide up the land so that you will have your own land and I and my relatives will have our own land. We will live in peace and I will promise not to hunt you or take your grass and trees.

"That's a good idea!" the vultures chorused.

"But" went on Man. "You must promise me one thing in return, you must allow me and my friends to visit you, to look at you and admire you and your great beauty."

"Yes, we will do that" replied King Lion. Lion was pleased with the thought that he was beautiful. "But you must only bring a camera not a gun. You must not kill us. You must leave us alone."

"I agree" said man.

And so the meeting ended and later the land was shared. That land which the animals received was called National Parks. It is still here today and man has kept his promise. For many, many years he has looked after the animals and the vegetation in National Parks, built fences to protect animals. These wild animals are very special, so special that other people from far away places come to look at the animals. They pay money to do this, they stay in hotels and camps built especially for visitors. They bring cameras but not guns. Our country earns a great deal of money by having people bring money from other countries to pay for their pleasure. We too can visit these National Parks and see these wonderful animals that are not found in countries outside Africa.

At the end of the story use the map of Rhodesia to show where some of our major National Parks are.

Behavioral Objectives:

i) Pupils will be able to make the sound or demonstrate some behavioral characteristic of at least one wild animal.

ii) Pupils will be able to give two arguments from a wild animal's point of view and two arguments from man's point of view as to why National Parks are a good idea.
Rhinocerus lying down to rest in the grass

2 rhinoceruses feeding on grass

This rhinocerus is further back also feeding on grass
1. What animal are you?

2. What do you eat?

3. How many horns do you have on your head?

4. Are your eyes small or large?

5. Do you sometimes lie down?

6. What do you do when you are angry?

7. Where do you make your baby walk to protect it?

8. You have small eyes. Do you think you can see well?

9. The man in the picture is 1.5 m tall. How tall are you (roughly)?

10. The mass of the man is 50 kg. A rhinoceros is equal to the mass of 50 men. What is your mass (kg)?
Dear Teacher,

To see whether there is a gain in knowledge as a result of the following lessons, we would like you to give a test before teaching these lessons and then again afterwards. For the first test tell the pupils not to worry if they don't know the answers or what it is all about. We expect very poor results for the first test.

Before starting, divide the pupils into groups and give each group an animal to be—the picture sheets will show you the animals they can choose from. They must be the same animal all through the lessons—and for the pre- and posttests. Try not to have more than 5 pupils per group. Now give each pupil a piece of blank paper (supplied), ask pupils to write their name, grade, and school on the papers. For the pretest answer the first question only of the evaluation exercise. Collect all the papers. For the posttest give each pupil his own paper back again and let him answer question 1 again, on the reverse side of the original paper. For the posttest pupils answer question 2 as well (about the map, papers provided).

Please give 10 samples of pupils' answers to your headmaster for returning to us.

Choose 5 good ones ) Question 1 and
and 5 medium ones ) Question 2.

Yours sincerely,

Environmental Science Working Party
Evaluation

Here are two exercises for the pupil to do. Remember these are to test our lessons and not your skill as a teacher. Please do not help your pupils.

1. You, the teacher, have just received a strange letter from a Kangaroo in Australia. This is what the letter says:

I want to find out about the wild animals in Africa. I am no good at writing letters or drawing. Instead here is a word picture about myself:

Tell pupils about this and put the word picture on the board. Start in the middle with the word Kangaroo and then attach the things that tell you about the Kangaroo to it. This is called a "hook up" picture!
Please, teacher, draw me on the board if you can.

Ask your pupils to send me a word picture about the animals in Africa. I wish I could come and see you but there is too much sea between Africa and Australia.

Love,

Kangaroo

Pupils must now make "hook up" pictures about the animals they are.
Pupil Test

Name __________________________________________

Grade ________________________________________

School _______________________________________

Make a word picture below which tells all about the animal which you are pretending to be.
2. Here is a map of a place where wild animals and man animals all want to live.
1. Draw a fence on this map to show how a National Park was made for the wild animals. Look at the key on the map to see the sign for a fence.

2. Show on the map which place is now for the wild animals to use and which part is for man-animal.

3. Give 2 reasons why the wild animals wanted to have a National Park:
   (i) ____________________________________________
   (ii) ____________________________________________

4. Give 2 reasons why the man-animals wanted to have a National Park:
   (i) ____________________________________________
   (ii) ____________________________________________

Write your name here: ____________________________

Grade: _________ School: _________________________
**Teacher's Questionnaire**

Please fill in and return to us via your Headmaster.

Teacher's Name ___________________________ Grade ________________

Name of School ________________________________________________

Urban or Rural ________________________________________________

Please note, these questions are not to test your teaching but rather how successful our lessons are. Please answer honestly.

**Part One**

*(Read this after you have taught the lessons)*

<table>
<thead>
<tr>
<th>Lesson 1</th>
<th>Lesson 2</th>
<th>Lesson 3</th>
<th>Lesson 4</th>
<th>Lesson 5</th>
<th>Lesson 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dates on which lessons were taught, e.g., 7/10/78.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Minutes of class time spent on each lesson.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Pupil Interest: Place one tick on each line to indicate what portion of the class showed:

<table>
<thead>
<tr>
<th>None</th>
<th>Up to 1/4</th>
<th>1/2</th>
<th>3/4</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>High interest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate interest or indifference</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance or dislike</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
In the following questions please use a ✓ or X where appropriate.

4. Materials required:  
   ___ Easy to get,  ___ Hard to get,  
   ___ Unobtainable.

Which materials were hard to get or unobtainable?

5. The lessons were:  
   ___ Too easy,  ___ Too difficult,  
   ___ All right.

6. What were new words for pupils? Give examples.

7. Did pupils have difficulty in understanding any of these words? Give examples.
   ___ Yes  ___ No

8. Were instructions to teacher clear?  
   ___ Yes  ___ No

   Comment.

9. Will the knowledge gained from these lessons be something that will help pupils in everyday life?
   ___ Yes  ___ No

10. Did you omit any parts of these lessons?  
    ___ Yes  ___ No

    Reasons?

11. Your rating of these lessons:  
    ___ Worthwhile keep as it is.  
    ___ Of value but needs revision.  
    ___ Worthless do not use.

If revision is needed, what do you suggest?
12. Did pupils achieve the behavioral objectives of the lessons?
   ____ Yes  ____ No

   Please comment on results of the test or evaluation exercise here:

   ____________________________________________________________
   ____________________________________________________________

13. Any other comments:

   ____________________________________________________________
   ____________________________________________________________

Part Two

Specific Questions on Wildlife & National Parks:

Lessons I & II:

1. What problems occurred when pupils answered questions about animals using the picture sheets?

   ____________________________________________________________

2. How many "animals" did each pupil find out the answers to? One, or two, or three?

   ____________________________________________________________

3. Which were the most popular animals, i.e., which ones did the pupils want to be most?

   ____________________________________________________________

4. Which were the least popular animals?

   ____________________________________________________________

Lesson III:

5. Were there any problems about sorting animals into groups according to what they eat, how they use trees, rocks, and grass? Comment.

   ____________________________________________________________
Lessons IV & V:

6. Please comment on your demonstration of map making. Did you use any of your own ideas in trying to make pupils understand map making?

7. What did pupils find difficult when they made their own maps?
LIST OF PUBLIC AND COMMUNITY AGENCIES, ORGANIZATIONS, AND INSTITUTIONS INVITED TO PARTICIPATE AT REVIEW OF CURRICULUM PLAN

1. Ministry

i. Education

Secretary
Deputy Secretaries (S) and (B)
CEOs (N) and (D)
Dep. CEOs (W), (M), (M)
Regional Education Officers—Secondary Inspectorate: Brewer, Sibanda, Palgrave, Michie, Attwood, Pritchard, & Bulawayo
Primary Education Officers with special responsibilities in this field
Education Development Unit, including Heberden/Brabbe and Cross/Wilkinson and K. Rea and R. Bezuidenhout (RECCE)
Teachers' Colleges—Chiduka (Mkobo), Mapongwana (UCE)—Lecturers in charge (Taylor, Beaver)
Supervisors and Headmasters with special interests in this area

ii. Health—Miss Allaart, Mrs. Middleton

iii. Parks and Wild Life—R. Thomson and Ferrer

iv. Natural Resources Board—Mr. Brightman and Mrs. Hughes, Mr. M. Sifelam

v. Agriculture—Dvag—Prov. Agric. Officer, Manicaland, and D. White-Spunner; Conex—I. McClennan, Elwell

vi. Forestry Commission—B. Fuller

vii. Mines

viii. Transport

ix. Water Development—R. Hack

x. TILCOR—M. Coleman

xi. Atlantica Ecological Research Station—R. Boulton
xii. Rhodesian National Farmers Union

xiii. Chibero College

2. University
   i. Department of Agriculture—Professor M. Schweppenhauser
   ii. Veterinary Research—Dr. D. Chavanduka
   iii. Adult Education—Professor D. Russel, Mrs. A. Gerrity
   iv. Education—Professor S. Orbell
   v. Geography

3. Museums—Miss Somers and M. Sanderson

4. Resource Education Committee—Mr. Handover (Chairman)

5. Young Farmers Clubs—National Secretary, I. Ehlinger

6. Community Development—Director M. Cuerdon and Hancocks

7. Freedom from Hunger—Mr. Leeds

8. Family Planning—Mr. P. Dodds

9. RTA/ZITA—Presidents

10. Scouts and Guides—Chief Commissioner, Mrs. J. Johnson

11. Commerce and Industry
   i. Anglo American
   ii. Rio Tinto
   iii. ARnI
   iv. ACCOR
   v. Whitsun Foundation

12. Prime Minister's Adviser on Energy: J. West *UDC Building)
    J. Johnson
    H. Metlercamp

13. Audio Visual Services
14. Agricultural Market Authority—E. Cross

15. World Vision—Rev. G. Strong

16. Emergency Education Association—Secretary to Council: J. Matthewman
APPENDIX N

COMPOSITION OF THREE DISCUSSION GROUPS WHICH REVIEWED
THE CURRICULUM PLAN

Discussion Group A

Chairman: K. Napier, Ministry of Education
Rapporteur: I. Craigie
Working Party Members: A. Crabb, Mrs. S. Parker, Mrs. S. Wilkinson

Prof. G. Bond
R. Boulton
G. Brewer
Dr. D. Chavunduka
S. A. D. Chirenda
Dr. L. Chitsike
P. Chitsunge
Mrs. B. E. Donkin
B. B. Gabi
P. Hancock
W. C. Kuwaza
C. Lang
I. MacLennan
Dr. C. H. D. Magadza
N. Nyereyemhuka
J. Oliver
S. L. Shumba
M. P. Stuart Irwin
Miss J. Zulu

U.R. & N.R.B.
Atlantica Ecological Research Station
Education Officer, Salisbury
Dept. of Veterinary Services
ZUPO
Whitsun Foundation
Ministry of Health
Ministry of Water Development
Chitsere School
U.R., Institute of Adult Education
Central Laboratory of Roads Dept.
Conservation Trust
CONEX & NRB Resources Education Committee
U.R., Zoology Dept.
Msengezi/Kutama Council
Primary Schools Education Officer
Agricultural Marketing Authority
National Museums and Monuments
Sterling Products International Ltd.

Unattached to Groups:

Prof. P. Gilbert
T. Muller
A. Siemers
W. Warke

Science Education Centre, U.R.
National Herbarium & Botanic Garden
Deputy Secretary, Schools Education, M. of Ed.
Deputy C.E.O., Primary Education
Discussion Group B

Chairman: I. Sibanda, Ministry of Education
Rapporteur: R. Bowler, Umtali TTC
Working Party Members: Mrs. I. Allen, L. Cross, D. Witt

C. Beaumont
B. Bezuidenhout
P. de Bruijn
I. Ehlinger
B. R. Fuller
L. P. Gezimati
T. B. C. Harding
R. A. Laming
B. Majukidze
J. Makina
W. Manatsa
N. S. Mtakwa
Dr. C. Mutambirwa
J. Fritchard
A. G. Rumano
M. Sanderson
Prof. M. Schweppenhauser
M. L. Sifelani
D. White-Spunner

Agric. Development & NRB
Environmental Studies, Salisbury
Chief Education Officer, Salisbury
Rhodesian YFC Association
Rhodesia Forestry Commission
Makundano Govt. School
Salisbury Publicity Association
Groombridge School
ZITA
Nat. Parks & Wildlife Management
Dept. of Veterinary Services
Domboshawa Training Centre
U.R., Geography Dept.
Education Officer, Salisbury
ZANU
Nat. Museums and Monuments
U.R., Dept. of Crop Science
Dept. of Natural Resources
CONEX

Discussion Group C

Chairman: N. Goto, Ministry of Education
Rapporteur: W. Michie, Ministry of Education
Working Party Members: C. Chimombe, R. Heberden

Prof. N. Atkinson
H. Attwood
R. M. Baty
Miss H. Benoy
Mrs. Chikara
J. Dambamuromo
B. D. Elkington
B. L. Karadzandima
Mrs. N. Kuwana
A. Kuksyna
J. M. D. Manyika
S. W. Mazivanhanga
Mrs. Middleton
M. Mills
T. G. Molife
Miss A. Mugwara
O. Saunyama

U.R. Dept. of Education
Education Officer, Salisbury
U.R. Institute of Education
Blakiston School, Salisbury
Family Planning Association
Dept. of Community Services
Chitungwiza Urban Council
Anglican Church Mashonaland Diocese
Womens Group Liaison
Seki Council
Supervisor of Schools, Min. of Ed.
ZUPO
Ministry of Health
Citizens Adv. Bureau
Chitsere School
Dept. of Community Services
ZANU
Miss H. Summers
P. K. Taylor
Mrs. P. van der Linden
F. Zimunya
M. Conchar

Natl. Museums & Monuments
Gwelo T.T.C.
Salisbury Publicity Association
Mashonaland East Prov. Authority
Ministry of Education
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