


PERCEPTIONS OF FIRST YEAR BIOLOGY STUDENTS) AT A COLLEGE OF EDUCATION  
TOWARDS THE/RELEVANCE OF POPULATION DYNAMICS AS/ PRESCRIBED  
FOR CURRENT BIOLOGY/SYLLABUSSES AT MATRICULATION LEVEL  
IN SOUTH AFRICAN SCHOOLS

BY



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IN THE DEPARTMENT OF BOTANY OF  
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WESTERN CAPE .

PROMOTER: PROFESSOR B. MC KENZIE

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BELLVILLE, MARCH 1992

I declare that PERCEPTIONS OF FIRST YEAR BIOLOGY STUDENTS AT A COLLEGE OF EDUCATION TOWARDS THE RELEVANCE OF POPULATION DYNAMICS AS PRESCRIBED FOR CURRENT BIOLOGY SYLLABUSES AT MATRICULATION LEVEL IN SOUTH AFRICAN SCHOOLS is my own work, and that all the sources I have cited or used have been acknowledged and indicated by means of complete references.



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## ABSTRACT

Throughout this research an attempt has been made to assess the perceived relevance, if any, of the Population Dynamics topic of the standard ten Biology syllabus, especially of those standard ten pupils enrolling as student teachers at a College of Education.

From this investigation, various factors, such as lesson methodology, practical field-work and time restraints amongst others, cause most pupils to misconstrue the relevance of Population Dynamics. Recommendations forwarded suggest an in-depth restructuring of the ecology aspects of the Biology courses at College by integrating content acquisition more closely with methodology than is evident at present. This will foster confidence and skills competence in aspirant teachers as they cultivate an environmental ethos in their classrooms. In addition, attention is focussed on Energy Flow as a sample topic for transformation from the theoretical to a more relevant and functional approach. In the absence of a definite commitment to the importance of improving teaching and learning methods in the presentation of this topic, most pupils fail to understand the important role of Population Dynamics in a study of Ecology. against global degradation.

## ACKNOWLEDGEMENTS

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To the students of Hewat College of Education and the pupils of the Guguletu Spring School of 1991, my sincere thanks and gratitude for sacrificing time and effort in completing the questionnaires and workshops.

For strength, health and perseverance, I give praise to my Maker.

I would also like to thank my wife Olivia and my children Kim, Lyle and Erin as well as my mother Joyce for their support, encouragement and understanding at the most crucial stages of this project.

Finally I would like to dedicate this dissertation to the memory of my late father RICHARD STEPHEN LANGENHOVEN who loved quoting from Proverbs 3: 19,20

"The Lord by wisdom founded the earth;  
by understanding he established the heavens;  
by his knowledge the deeps broke forth,  
and the clouds drop down the dew".



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PRESCRIBED FOR CURRENT BIOLOGY SYLLABUSES AT MATRICULATION  
LEVEL IN SOUTH AFRICAN SCHOOLS.

CHAPTER ONE: ORIGIN AND BACKGROUND TO THE INVESTIGATION

1.1 INTRODUCTION: A LITERATURE SURVEY

Population Dynamics is a Biology unit of the NEW BIOLOGY SYLLABUS for standard ten, which was implemented into the National Education Curriculum of South African Schools in 1986. Population Dynamics, a unit of the current Biology syllabus, is intended to focus on aspects of living biological populations (fauna and flora) as they integrate with the abiotic and biotic environment, where the stability/instability balance can ultimately have a favourable or unfavourable impact on the quality of life for man.

The important task of this investigation is to determine the necessity, if any, of:

"....aligning the environment more closely to relevant frames of reference in the classroom, so as to acquire insight into the dynamics of the topic and it's impact on the survival of man".

(Schibeci, Rideng & Fraser, 1987).

Concern has been expressed by numerous writers about the lack of "connectedness" between what the pupil is taught and the application of this knowledge to the realities of life.

Watson (1990), is of the opinion:

"....that very little relevant biology is taught. That a biologically literate and functional society is essential for the survival of the individual, the country and the planet".

Biology into the 21st Century demands:

"....an integrated approach. The emphasis on the environment fosters an intelligent respect for nature and assists in decision - making. Without that respect we are in danger of destroying our life - support systems.

A scientifically literate population will enhance it's capacity for survival, to be at peace with itself and the environment" (A.A.A.S, 1989).

## BACKGROUND

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South African citizens can be placed in THREE GROUPS according to Watson (1990):

### GROUP ONE: LIFE SUPPORTING GROUP:

Includes environmentalists, agriculturalists, health care workers and educators, who are charged with the task of managing life - sustaining systems.

### GROUP TWO: DEVELOPMENT AND TECHNICAL GROUP:

Includes structural developers, law makers, technicians, economists. Decisions made by this group have the potential of impacting positively or negatively on the environment.

### GROUP THREE: MARGINAL GROUPS:

Includes unemployed, poverty-stricken, laborers and rural dwellers. The largest concentration of this group were initially in the homelands and rural areas. With work opportunities deteriorating in the rural areas, the unemployment figures started to increase, resulting in a migration of job-seekers from rural to urban areas where squatter communities developed on whatever vacant land could be found.

Since the political, socio-cultural and economic status of the three groups mentioned above, places a varying demand on the fragile natural environment for sanitary services,



**BACKGROUND**

food and housing, health care, energy resources, industries, agricultural needs and water amongst others, degradation of the environment could follow in the absence of proper management. Our education obligation should focus on providing relevant biological knowledge that should support mechanisms of survival for the marginal groups and stronger conservation ethics for the decision-making groups.

Yager (1982), observes that:

"Science educators fail to note that most of the science that is being taught is not related to the problems that exist in today's society. There is a mismatch between the science taught and the science needed".

Dr. Danie Schreuder (1991), addresses the question of relevance in Biology Education and identifies:

"A relationship between a Human Biology on bio-social issues and ecological concerns, in the natural environment. This link has shifted proposed interest from the academic study where biology is taught informatively in the belief that knowledge thus acquired would be useful to pupils in the future, to a situation where values, skills and attitudes are interconnected in an environmental education concept".

**BACKGROUND**

Raitt (1985) initiated an investigation into attitudes and perceptions of First Year Botany and Biology students at University of Western Cape, towards practical work, as experienced in the 1984 Matriculation Biology course.

Raitt used a questionnaire to collect data which is reflected in Table 1 below.

**TABLE 1: UWC First Year Student's exposure to Practicals at schools.**

	COMMENT	RESPONDENTS %
* Experimental observation:	few	66%
* Experiments done:	none	60%
* Microscope used:	not at all	56%
* Extra reading:	occasionally	57%
* Field Trips:	none	85%

The results in Table 1 reveal that over 60% of students had no practical laboratory experience and a staggering 85% of these students were not exposed to nature's outside laboratory through field trips.

Practical work in the form of individual and group experimentation, as well as personalized biology field - work, provides a visual learning experience for both teacher and pupil, where scientific skills as well as aesthetic appreciation of the environment can be acquired. Evidence showed that First Year students at U.W.C. in 1985 were ill-equipped to enter the Botany and Biology courses.

## BACKGROUND

This study by Raitt into students' perceptions of practical work in biology as experienced at matriculation level related to the complete course. With the introduction of the New Biology Syllabus on a National level into South African schools in 1986, an ecology component called **Population Dynamics** was added.

The preamble to the New Biology syllabus for both Higher Grade and Standard Grade in the Education Bulletin SS9 (1986) gives the dates of implementation of the syllabus as follows:

"The syllabus for Biology for Standards 8, 9 and 10 set out below replaces the syllabus for Biology for Standards 8, 9 and 10 published in Education Bulletin SS 9 dated 15 April 1977 and comes into effect on 1 January 1986 in Standard 8, 1 January 1987 in Standard 9 and 1 January 1988 in Standard 10".

The New Biology Standard Ten Syllabus has been operable for the last three years (1988 to 1991), a period which has seen a dramatic shift to Environmental Education (E.E.) as a theme being echoed in all walks of life.

Raitt's (1985) findings in Table 1, gives a possible comparison for the findings of this investigation [Perceptions of the Relevance of Population Dynamics] with

## BACKGROUND

respect to any change in the students' experience of practical work, such as field-trips for example. Although Raitt's questionnaire was directed at the entire standard ten Biology Syllabus, and this investigation only concentrates on one unit, namely **Population Dynamics**, the overall practical activities remain similar.

An assessment of student perceptions of **Population Dynamics** could contribute to evaluating the relevance of this topic towards enhancing an environmental ethic.

### 1.2 RATIONALE FOR RESEARCH INTO THE RELEVANCE OF POPULATION DYNAMICS

There is legitimate concern regarding **Population Dynamics** and its impact if any on moulding and preparing pupils to reach an understanding of human values, attitudes and behavioral relationships as determined and influenced by teaching strategies and techniques, in order to survive the demands of a life dependent more and more on a need to sustain a balanced environment for the earth's inhabitants. Schreuder (1991) is of the opinion that pre-service training for teachers of the sciences, should make provision for exploring relationships that exist between affective and cognitive domains of human experience. By looking at different learning models and by discussing and analyzing alternatives one could realise these objectives.

## BACKGROUND

The contextual knowledge inherent in the core unit of **Population Dynamics** consists of theoretical concepts, supported by data tables, graphs and diagrams with scant opportunity for discussion around topical environmental issues. The objective of all biology teachers should be to inculcate an environmental ethic in pupils by **connecting classroom work with local experiences.**

Colleges of Education are the main group of institutions concerned with training teachers for the Junior Primary and Senior Primary schools. These prospective teachers have an invaluable opportunity to transfer environmental ethics at grassroot level to the primary school pupils.

Since Colleges of Education are concerned with the preparation of prospective teachers, an investigation into the attitudes and perceptions of these new recruits towards the environmental component, could assist biology teachers, lecturers and curriculum planners in formulating a more relevant approach towards the teaching of **ecological** programmes at Matriculation and College levels.

Teachers with the necessary skills and initiative can create learning situations beneficial to the inculcation of environmental values in the pupils. Teachers need to ensure that pupils who are the decision makers of tomorrow, are suitably prepared for this task [O'Donoghue and McNaught, 1990].

**BACKGROUND**

The thrust of the investigation would therefore attempt to focus on **THREE** areas, namely:

- (1) The identification of problem areas in Population Dynamics.
- (2) The selection of ONE such problem area for further analysis,  
and
- (3) To forward recommendations on ways to supplement and encourage active student participation and awareness of the selected problem area by analyzing student Perceptions of Lesson Methodology and their Expectations of a course in Ecology.

In summary it can be stated that the importance of this investigation is to consider the extent to which students who are enrolled for the First Year Course at Hewat College of Education, under the Department Of Education And Culture, House of Representatives, perceive the relevance of Population Dynamics.



**BACKGROUND**

The perceptions and expectations of these First Year students could contribute to democratizing the initial planning of a curriculum for ecology programmes.

Students should be in a position to state that they have an:

"..... acute environmental awareness about ecological interdependence in both urban and rural areas.

(UNESCO-UNEP, 1978 p.3 in Clacherty, 1990)

In other words students should feel free to contribute to a programme that fulfills the needs and expectations of the community. The intention is therefore to democratize education by focussing on the needs and expectations of the learners in the education community.

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## CHAPTER TWO: SELECTION AND PROCEDURAL ORGANIZATION OF THE TEST SAMPLE

### 2.1 SELECTION OF THE TEST SAMPLE

In order to involve students in democratizing curriculum planning processes at Colleges of Education, one could solicit input from students at First Year Level. Since students who enroll at Colleges of Education are compelled to take Biology as a First Year course, a sample group of First Year students at Hewat College of Education were selected from the 180 First Year enrollment for the year 1990, as respondents.

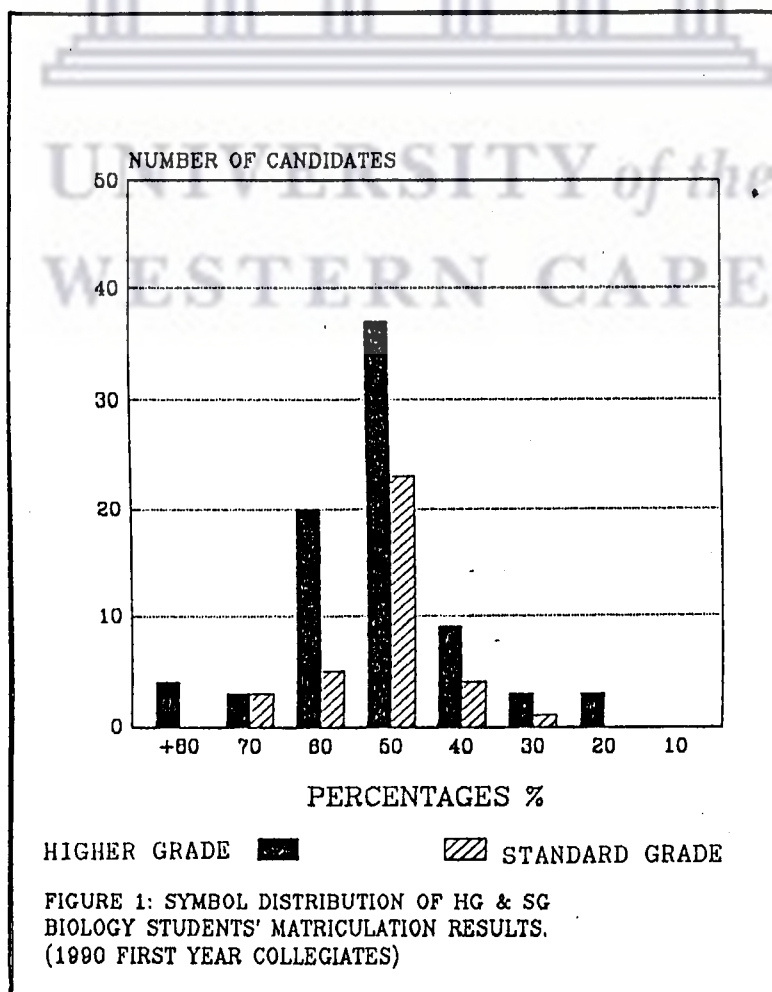
At least 36.2% (65 out of the 180 registered students) of the First Year intake at Hewat College of Education in 1990 indicated little or no exposure to basic ecological concepts, when interviewed (this group represents students who matriculated prior to 1988 as well as those who did not offer biology as a matriculation subject).

The remaining 115 First Year Hewat College of Education students enrolled for the year 1990, satisfied the qualification specifying that the study period for the Biology Matriculation course should have been followed in the years 1988 and 1989. This elimination procedure ensured that all the students in the sample had been exposed to a study of Population Dynamics.

### THE TEST SAMPLE

A cursory look at the overall symbol distribution obtained by the 115 respondents for Biology reveals that 79 candidates offered Biology on the Higher Grade and 36 candidates offered Biology on the Standard Grade.

The average overall (Higher Grade and Standard Grade combined) Biology symbol obtained was D (50-59%) achieved by 55,6% (64 candidates), 27,8% (32 candidates) filled the C to A symbol range (60% to 80%) and 6% (7 candidates) failed the subject. The distribution curve of the symbols of the sample is normal as can be seen from FIGURE 1, which indicates a wide spread of students of varying academic biological ability.



## THE TEST SAMPLE

These symbol distribution trends can serve as an indicator of a students' ability in the subject and the investigation could reveal the extent to which cognitive skills balances with aesthetic values.

## 2.2 TEST ORGANIZATION

Population Dynamics as mentioned earlier was introduced into the Biology Standard Ten syllabus in 1986, implemented on 1 January 1988 and written for the first time by House of Representatives: Department of Education and Culture pupils in November 1988 [Education Bulletin SS9, 1986].

Sex, language, age and area of school attended, were not regarded as variables affecting this investigation, serving merely as possible indicators for further study.

Covert variables experienced by most disenfranchised schools in South Africa, such as political upheavals, school boycotts, stay-aways, examination disruptions and adverse socioeconomic conditions may to a greater or lesser extent impact on the results of the investigation. These variables were also not considered when formulating the questionnaire, because attention needed to be focused on the subject matter of Population Dynamics only.

**THE TEST SAMPLE**

This investigation was conducted using a questionnaire consisting of FIVE sections.

\* **SECTION A: STUDENT INFORMATION:**

For orientation purposes.

\* **SECTION B: GENERAL PROBE:**

Consisting of 15 YES/NO questions.

\* **SECTION C: LESSON METHOD ANALYSIS:**

Consisting of a table of Lesson Method choices for each Population Dynamics topic.

\* **SECTION D: PREFERENCES:**

Questions eliciting responses about the relevance of Population Dynamics in day-to-day activities.

\* **SECTION E: PERSONAL OPINION:**

TWO questions eliciting a personal opinion about the future of the environment.

The complete text of the questionnaire is indicated in APPENDIX B. All the questions were phrased as concisely as possible, with the Afrikaans translations being validated by the Afrikaans department of Hewat College of Education. The questionnaire employs interlocking questions for the purpose of correlating key responses.

### THE TEST SAMPLE

The analysis of the study is more QUALITATIVE than STATISTICAL. Such an analysis, besides being more understandable to biology teachers and college students, serves the interest of the study best in terms of accessibility and readability.

The questionnaire was compiled and administered by the researcher after being approved by the Botany Department of U.W.C.

Frequency tables, pie-graphs and histograms are used to visually display the results for easier interpretation of the data collected.

The questionnaire was administered under strict supervision, by the researcher, ensuring that students responded individually, without peer discussion. All responses were treated in strictest confidence.

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## THE TEST SAMPLE

2.3 AN ASSESSMENT OF THE RESPONSES TO THE GENERAL PROBE  
SECTION B: AWARENESS LEVEL OF THE SAMPLE TO  
POPULATION DYNAMICS.

The purpose of these questions are intended to assess the level of awareness by the sample about POPULATION DYNAMICS, as determined by past, present and future experiences.

The following group of questions creates an atmosphere of confidence and serves as a focus for answering later questions, that solicited opinions and suggestions. In retrospect, some of the questions were far too general and the results are open to interpretations suited to the researcher's frame of reference. Too many Yes/No questions failed to accommodate an attitude scale, making the answers too decisive, for example:

Question 3. Did you experience an organized field trip with your standard ten class?

[YES - 6,5% : NO - 93,5%]

instead of

[ No Occasionally often]

Although the response is negative, no room is allowed for finding out reasons for this negative response. An attempt is made in the rest of the questionnaire to identify some of these problem areas, but the question could have been more closely linked to a wider area of concern almost immediately.

## THE TEST SAMPLE

Some of the questions would probably have been more effective if reasons for the responses were solicited, for example Question 14 asks:

"Would you have preferred more exposure to ecological concepts in the standard ten course work?"

[YES - 96% : NO - 4%]

This response indicates a need, but is this a need for more ecology linked work, or a lack of methodology in presenting Population Dynamics, or not seeing Population Dynamics as an ecology topic or any other reason.

In spite of the reservations about the compilation of these questions, certain trends do emerge in the perceptions that students hold of Population Dynamics.

The THREE categories (past, present and future experiences) are represented by the following groups of questions:

\* CATEGORY 1...Pre - matriculation perceptions of ecology

(Questions 1,4,11,13,15)

	YES	NO
	%	%
1. Did you enjoy biology lessons?	89,8	10,2
4. Do you regard the problem of pollution as one to be solved by the Nature Conservation Department?	37,2	62,8

## THE TEST SAMPLE

	YES	NO
11. Is there a difference between Population Dynamics and Ecology?	51,7	48,3
15. Did you find that the ecological study at Std. 8 level facilitated your understanding of Population Dynamics?	49,1	50,9

In CATEGORY 1 89,8% of the students viewed biology lessons in a favorable light as compared to 10,2% who disliked the subject. This indicates that the majority of respondents could find some interest in answering this questionnaire. The problem of pollution was regarded by 62,8% of the respondents as a concern of all but 37,2% did not see the necessity of involving themselves in this problem, which could point to apathy or lack of appreciation for environmental problems. The response rate show that there are students who in spite of exposure to ecology principles show a measure of apathy, although the reasons for this view have not been clarified. Half (51,7%) of the respondents thought that Population Dynamics was distinct from Ecology (Question 11), while the response to Question 15 also showed a 49,1% to 50,9% (half) response rate to understanding the link between Ecology and Population Dynamics.

## THE TEST SAMPLE

The question was specifically asked to assess whether a change in terminology affected the students' perception of the meaning of the topics mentioned therein.

\* CATEGORY 2...Practical exposure to ecological concepts[Questions 2,3,5,6,7]

	YES	NO
	%	%
2. Do you think that the practical work component of the biology course was sufficient for the year (1989)?	36,8	63,2
3. Did you experience an organized field trip with your Std. 10 class?	6,5	93,5
5. Would you have preferred more practical work on the population dynamics topic?	94,2	5,8
6. Are you a member of a hiking, mountaineering or outdoor club?	22,9	77,1
7. Would you have preferred less practical work on the population dynamics topic?	4,0	96,0

### THE TEST SAMPLE

The questions in CATEGORY 2 were phrased in such a way as to determine the volume of controlled practical work executed for population dynamics and to identify any transference or connectedness between school field-trips and extramurally organized outdoor clubs.

The results show an overwhelming response by students for more practical exposure.

Questions 2,3,5,6 and 7 highlight the practical work application component and 63,2% (Question 2) of the respondents were in favour of more practical work. Furthermore field-work featured low in the practical work component, with a meagre 6,5% (Question 3) of respondents having experienced a field trip.

#### \* CATEGORY 3...Relevance of Population Dynamics

[Questions 8,9,10,14]

8. Did you find that the graphical illustrations on population dynamics helped your understanding of this topic?
9. Do you feel that a study of population dynamics has influenced your view of ecology?

	YES	NO
	%	%
8.	76,4	23,6
9.	84,0	16,0

## THE TEST SAMPLE

10. Do you think that Primary School pupils need more exposure to ecology than Secondary School pupils?
14. Would you have preferred more exposure to ecological concepts in the Std. 10 course work?

YES	NO
%	%
80,4	19,6
96,0	4,0

CATEGORY 3 questions were phrased to assess the students' understanding of the relevance of this topic. However Question 9 and Question 10 are once again far too vague leaving too much of a subjective interpretation because of the lack of substance in the Yes/No responses. For this reason these questions can be ignored. Question 14 has more direction, where 96,0% of respondents clearly indicate a need for more environmental exposure, probably of a practical and field - study nature, as indicated in some of the earlier responses (Questions 2, 3, 5, and 7).

In summary it can be stated that the General Probe Questions should have been streamlined to avoid repetition, obvious responses and irrelevant questions. Allowance should have been made for scaled responses and opportunities to motivate selected responses.



## THE TEST SAMPLE

The results do indicate a need for a hands - on approach if students are to gain any benefit from a study of Population Dynamics.

A complete set of results can be found in APPENDIX A:

TABLE 2:[GENERAL PROBE INTO PERCEPTIONS OF FIRST YEAR COLLEGE STUDENTS TOWARDS POPULATION DYNAMICS], where the responses to the questions are recorded as percentages.

A strong measure of interest is shown by respondents to become more involved in ecology matters and especially to achieve a confident understanding of Population Dynamics, but undetermined factors may be impacting negatively on the further development of this interest. Evidence suggests a lack of practical application and fieldwork as contributing factors for this show of insecurity.

A considerable amount of effort is spent by Biology teachers in Std. 10 to complete the syllabus requirements by using a combination of teaching methods some of which are effective and others not.

Perceptions of these teaching methods were undertaken by the sample group, who analyzed the methods used to teach the Population Dynamics unit in the Biology Syllabus for Standard Ten, and recorded in Chapter Three.

CHAPTER THREE: ASSESSMENT OF PUPILS RESPONSES TO LESSON  
METHODS USED FOR TEACHING POPULATION  
DYNAMICS.

3.1 INTRODUCTION

Six lesson methods were identified and defined (APPENDIX B) as possible ways in which lessons could be taught, namely:

- \* PRACTICALS
- \* WORKSHEETS
- \* LECTURES
- \* SELF-STUDIES
- \* TUTORIALS
- \* FIELD-STUDIES

Respondents were also made aware that a lesson could be presented through using more than one method, and should be recorded as responses if this was the case. These methods were juxtaposed with the various aspects of Population Dynamics, as per syllabus prescription.

Students were required to tick off the appropriate method/s used by their teachers for teaching each Population Dynamics aspect. The number of responses (APPENDIX A: Table 5) per lesson method, were converted to percentages for display as a pie-graph.

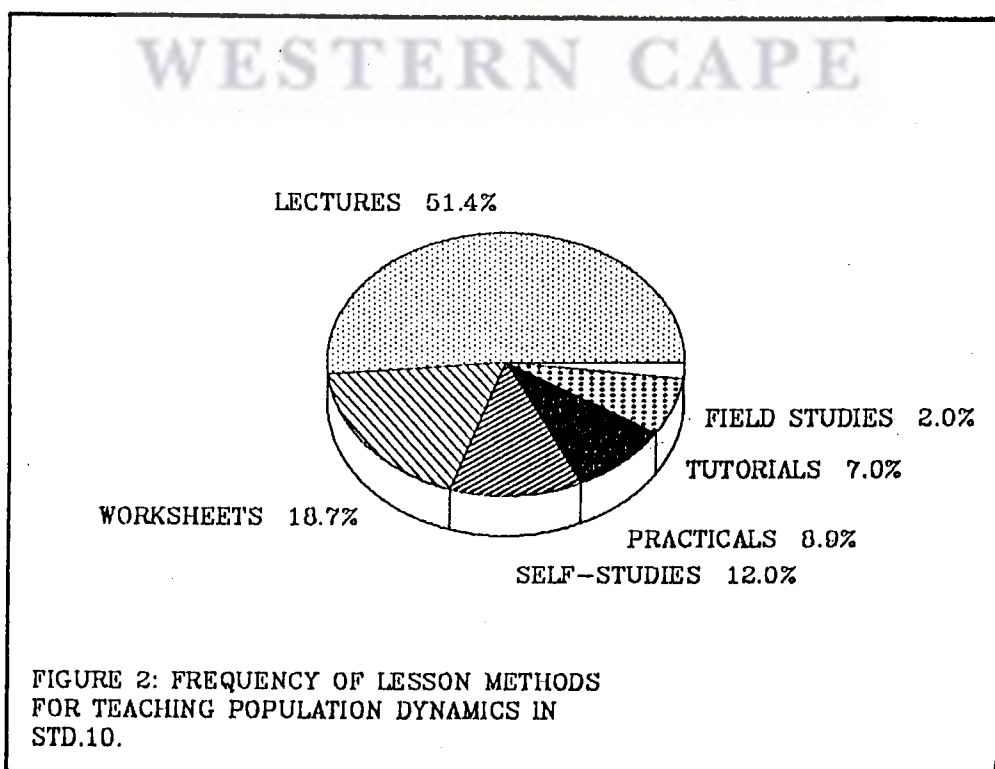
## LESSON METHODS

3.2 DISCUSSION OF LESSON METHOD ANALYSIS RESULTS

From the pie - graph (Figure 2) on Frequency of Lesson Methods, the results indicate a dominance by the LECTURE METHOD (51,4%), with PRACTICAL and FIELD-STUDY methods showing low percentages.

WORKSHEETS (18,7%), SELF-STUDIES (7,0%) and TUTORIALS (12,0%) combined, form one-third (37,7%) of the responses, seemingly indicating self-generating familiarization with aspects of population dynamics.

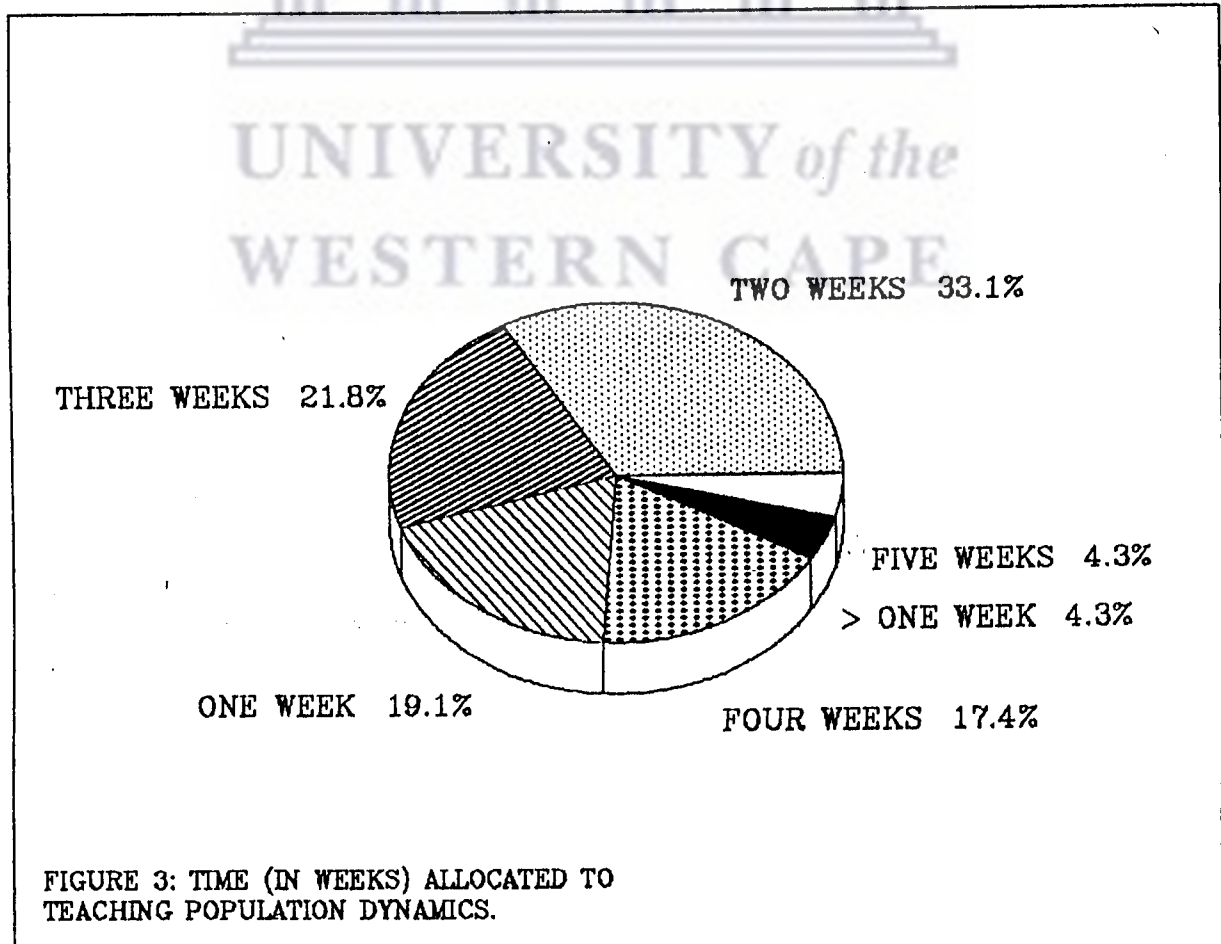
The WORKSHEET (18,7) enjoyed a measure of popularity, but the result does not correspond clearly with it's intended definition of supporting PRACTICALS and FIELD-STUDIES, as shown by the result of 8,9% for practicals and 2,0% for field-studies.



## LESSON METHODS

FIELD-STUDY was largely neglected, and if a case were to be made for greater environmental awareness, then a closer study should be made of the Biology Curriculum and the hidden constraints that teachers and pupils are subjected to.

Consider "time allocated (in weeks) devoted to teaching Population Dynamics" (Figure 3) as one example of a constraint having a possible negative impact on field-work, then clearly two to three weeks in the Third Term leaves very little opportunity for expansion into laboratory and/or environmental field experiences.



## LESSON METHODS

Professor Botha(1990) states that:

"...specialists were mostly utilized by teachers and youth organizations to guide and interpret what their pupils, students and members were looking at on field trips. If these specialists were not available, field trips did not take place, which in turn deprived the youth of South Africa of valuable learning opportunities and experiences".

[Council for the Environment (1990)

["Environmental Survival needs Environmental Education"]

In essence biology teachers are challenged to equip themselves with the skills needed for planning such learning experiences for their pupils. Colleges have a role to play in motivating student teachers, by re-orientating and restructuring biology courses to incorporate a strong environmental ethos. A need for readily accessible Environmental Education (E.E) coaching facilities is needed for in - service teachers interested enough to be tutored in E.E. methodology.

From Figure 3 (Time in weeks allocated to teaching Population Dynamics) twenty - seven students (23%) indicated that teachers spent one week or less on Population Dynamics, 54% (63 respondents) had received two weeks (33%) to three

**LESSON METHODS**

weeks (21,7%) tuition, with twenty students (17,4%) and 5 students (4,3%) receiving four weeks and five weeks tuition respectively. The interesting point to note, is that there were teachers who managed to accommodate a longer time slot for this topic. A follow - up on these 25 students with respect to determining if their teachers were able to implement practical/field work or not, could reveal useful teaching strategies.

From Figure 2 (Frequency of Lesson Methods for Teaching Population Dynamics), the lecture method clearly dominates, but the investigation has made no allowance for correlating "teaching time" with "lesson methods", which would provide a more useful means of determining whether students benefitted or not from a longer tuition time slot.

In summary the above results seem to favour a perceived need by students for:

- (1) Teaching methods to be reviewed in favour of practical approaches, and
- (2) Increased time for a comprehensive exploration of environmental concepts.



## LESSON METHODS

3.3 STUDENTS PERCEPTION OF POPULATION DYNAMICS.SECTION D: YOUR PREFERENCES.

The ethic value attached to the learning of any body of knowledge, be it;

- (1) a sensitization to environmental issues,
- (2) acquiring a basic understanding of environmental problems, and
- (3) equipping learners with skills for evaluating and finding solutions to local environment issues,

tends to become lost in the rush towards the completion of the syllabus in preparation for a matriculation examination. Teachers who are under pressure to complete the Biology syllabus in time for the examination could lose sight of emphasizing the relevance of the Population Dynamics topic during tuition time. To determine whether this idea had any substance, a series of questions were formulated for presentation to the sample group.

Question 22 (Consider the aspects of population dynamics mentioned in SECTION C, and write down the letter only, of those aspects that you found most interesting and stimulating) and Question 25 (Choose One aspect of population dynamics, that in your opinion has the most relevance to the survival of mankind. Give reasons for your choice) focuses directly on the topic and are therefore most suitable for further comment.

## LESSON METHODS

The rest of the questions (numbers 23,27,28,29) besides the one referring to "time" (Question 24), are general and of no immediate concern to this investigation.

From the pie - chart (Figure 4) based on the responses to Question 22, respondents regard POPULATION PARAMETERS (40%) and POPULATION GROWTH (25%) as the most interesting areas. The least interesting areas being, POPULATION SIZE (15%), POPULATION REGULATION (5%), DENSITY DEPENDENT & DENSITY, INDEPENDENT PARAMETERS (2%), PREDATION (5%), ENERGY FLOW (5%), COMPETITION (3%), and SURVIVAL STRATEGIES (none).

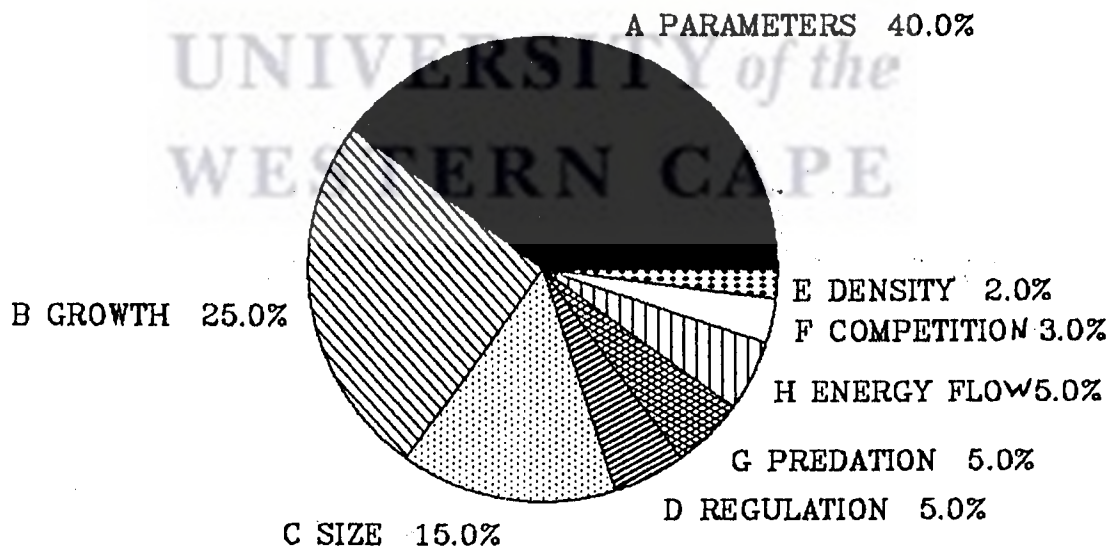


FIGURE 4: STIMULATING AREAS OF POPULATION DYNAMICS.

These results point to six out of nine Population Dynamics' areas that have very low rates of interest amongst the respondents. One cause could be the method used by teachers in the presentation of the topics in the learning situation, as can be seen from the pie-chart, Figure 2, of Lesson Method Analysis where 51,4% of the topics presented were in the form of lectures without an active practical support programme (practicals = 8,9%; field - studies = 2%).

An interesting result was obtained from Question 25

"Choose ONE aspect of Population Dynamics that in your opinion has the most relevance to the survival of mankind? Give reasons for your choice".

where TWO areas were popularly viewed as being relevant to the survival of mankind. These were Survival Strategies (38,2% = 44 students) and Population Parameters (28.6% = 34 students) which seem to indicate a growing concern for environmental matters. Although Survival Strategies were regarded as relevant in this question, it was non - existent on the scale of most interesting topic of Population Dynamics (Question 22 and Figure 3), and this seems to indicate that the presentation of the subject matter was neglected, thus failing to meet the expectations of students.

## LESSON METHODS

By analyzing some of the comments/reasons advanced by respondents, an idea of the quality of concept formation can be obtained, for example two students chose to comment on Competition (F) as follows:

- (1) Survival of the fittest leads to competition. Each person or animal for itself, leads to independence and possibly success.
- (2) For mankind to survive, there has to be a form of competition between them, for example, e.g. farmers will grow more food in order to sell i.e. make a profit.

Responses to Competition (F) show confused values with regard to human relationships and environmental conservation understanding.

Competition is seen to be a healthy activity benefitting mankind. This view can lead to a capitalistic, exploitative attitude that excludes mutualistic relationships.

This perception becomes more forceful when looking at the responses to Predation (G), where four students commented:

- (1) Man dominates over all life on earth. He was given a brain of a high calibre to outwit & think for himself. Man therefor has the power to save mankind through his ideas.
- (2) Man is the dominant living organism on earth, if there was any predator that could conquer man then we would

## LESSON METHODS

decrease in number. Also man can influence the survival rate of other animals, by becoming predators and killing other animals.

(3) Predation is leading to the extinction of certain animal species eg. hunting. Many species have been wiped out and in this way it affects various food chains.

(4) You find out more about how animals survive and how they feed on each other to survive.

Domination, exploitation are strong themes in these responses. Response three has a much better holistic view of the consequences of predation.

The three responses in support of Energy Flow(H) showed more insight than that of Competition (F) and Predation (G), linking energy and trophic levels in a fragile energy budget balance:

(1) If food chains are broken or energy flow is stopped at one point, it influences the whole ecosystem causing imbalances.

(2) It shows the different levels and forms in which energy is available to man.

(3) Mankind is destroying the balance of nature by killing too many animals. The food-chain and thus the energy flow will lead to an imbalance in nature with disastrous effects for mankind.

**LESSON METHODS**

Interpretation, understanding and conceptualization of the topics of Population Dynamics are revealed through verbal communication and through written expression, by using the correct terminology. To encourage conceptualization of these concepts, students should be given opportunities to speak and write creatively about the environment.

**3.4 LINKING POPULATION DYNAMICS TO REALITY****SECTION E: PERSONAL OPINION**

To extend this perception of how relevant students found Population Dynamics to be, TWO questions (Question 30 & 31) were finally formulated:

Question 30 [What would you expect from an ecology course at University or College of Education?]

The purpose of this question was to gauge students' expectations towards an ecology course at Hewat College of Education, with a view to determining a point of departure, for planning future ecology programmes.

Question 31 [To what extent does the course in Ecology prepare you for an understanding of the social, economic and political life of South Africa?] was formulated to determine whether students saw any relevance between their matriculation study of Population Dynamics and the broader social, economic cultural and political life of South Africa.



**LESSON METHODS**

Since current trends in syllabus development are based on the environment [evident from the White Paper on Environment Education (1989)], which also embraces the principles of the Tbilisi Declaration (1977), as well as the aims of E.E.A.S.A. [Environmental Education Association Of South Africa, 1982], these questions illicit the views of prospective primary school biology teachers.

The responses were classified into criteria as evidenced by the written responses, and plotted as bar graphs.

The selection of criteria was done by grouping similar sentiments expressed in the responses that had a bearing on environmental concepts. Since more than one criteria could emerge from a response, a certain amount of overlapping occurred and percentages of expectations (Question 30) and perceptions (Question 31) were difficult to determine, therefore the bar graphs reflect total number of responses per criteria.

## LESSON METHODS

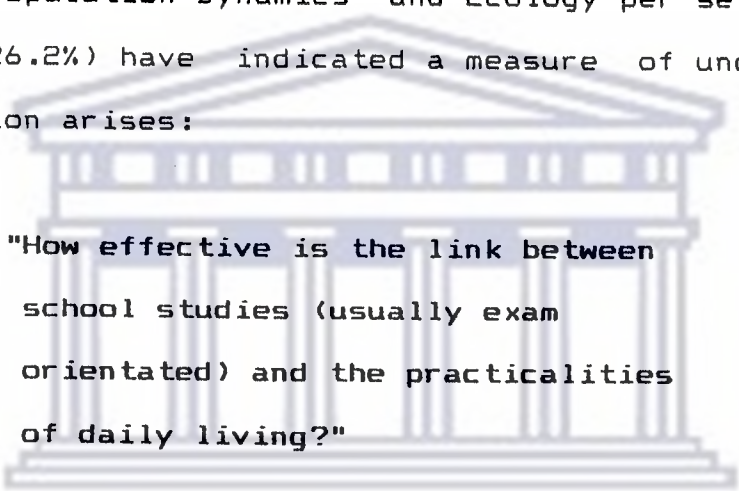
3.4.1 INTERPRETATION OF FIGURE 5

Figure 5 (Expectations from an Ecology Course at College, by First Year students) field-work and self-discovery (Criteria a = 65 responses) were by far the most popular expectation. Exposure to environmental problems (Criteria b) as compared to the above criteria enjoyed 35 responses. Eighteen responses were in favour of individual involvement in assisting with the solving of environmental problems (Criteria c). Discussions supported by audiovisual facilities (Criteria d) did not enjoy much support, probably due to a lack of initial exposure. Ten responses were completely devoid of insight (Criteria e) and course work with a view to community involvement (Criteria f) received fifteen positive responses.

There is a willingness by the respondents to acquire an environmental awareness ethic that would benefit their studies in Population Dynamics and encourage community outreach programmes. College environmental programmes should take cognizance of this expectation.

**LESSON METHODS****3.4.2 INTERPRETATION OF FIGURE 6**

From Figure 6 (Perception of the relevance of Population Dynamics in South Africa) an overwhelming 74,1% (Responses for Categories e to i = 89 out of Total Responses of 120) show confusion and lack of insight into the importance of a study of Population Dynamics and Ecology per se. Categories a to d (26.2%) have indicated a measure of understanding. The question arises:



"How effective is the link between school studies (usually exam orientated) and the practicalities of daily living?"

Watson (1990) is of the opinion that we teach students nothing of the ways that population dynamics and other biology aspects impinges on the life of ordinary people. To achieve this goal a suggested restructuring in a South African context could be:

- (1) Local Habitat Studies
- (2) Urban & Rural Complexities
- (3) Past, Present and Future scenarios of instability
- (4) Mutualism as an all- embracing Human Activity

**LESSON METHODS**

The means by which this restructuring would be most effective is through a careful consideration of:

- (1) Textbooks offering relevant field and laboratory approaches.
- (2) Researched projects, worksheets/workbooks of a topical and universal nature.
- (3) Flexible syllabus structure taking the vagaries of a South African society into account.
- (4) In-service teacher training through seminars, workshops, conferences that dynamically ensure self-reliance in the presentation of the work.
- (5) Continuous refresher courses.
- (6) Establishing closer links between the student and their immediate local environment/residence in terms of survival needs.

One cannot hope to convince, educate and create an awareness in pupils about the environment without reference to the socio-cultural, economic and political South African milieu. The needs of the pupils' home life, family and daily after-school environment, (which vary from levels of abject poverty to affluence), plays a decisive role in the priority placed by the pupils on the relevance of a study of Population Dynamics.

## LESSON METHODS

Biology teachers are faced with questions such as:

- \* What strategies are needed?
- \* How can strategies be linked to various changing social circumstances?
- \* What should be taught and with what objectives?
- \* Can strategies be effectively applied to illicit a desired awareness for an ecological ethic?

To address these questions an examination of perceptions could serve as a starting point in the restructuring process.

Early trends in teaching tended to emphasize teacher centredness rather than pupil empowerment. This was reinforced by inspectorial control, rigid syllabuses, emphasis on examinations and results. In short, acquisition of knowledge rather than aesthetic value and skill development, dominates the South African schools (Schreuder 1991).

This mismatch between the students cognitive goals and affective goals may be ascribed to various factors, some of which can be identified from previous findings in this paper, such as Lesson Strategies, and therefore requires urgent didactical reorientation and restructuring.

## CHAPTER FOUR: THE ENERGY FLOW DILEMMA

### 4.1 INTRODUCTION: WHY IS A STUDY OF ENERGY FLOW THROUGH AN ECOSYSTEM IMPORTANT

An understanding of Energy Flow is generally regarded by ecologists as essential for an appreciation of the dynamics of a community. All biological systems, [whether individual species, populations or communities], depend on effective Energy Flow for sustenance and stability.

The thermodynamic laws governing biological systems provide a better understanding of the interrelationships of organisms.

According to Putman & Wratten (1984), the importance of Energy Flow through an ecosystem is important for THREE reasons:

- (1) to put the individual organisms of a community in contact and to define more exactly their actual function in the system.
- (2) to extend this to a detailed analysis of the entire flow of energy through specific systems.
- (3) to restrict the consideration to one of energy flow between trophic levels and apportionment within them.



## ENERGY FLOW

Although the focus is on Energy Flow, cognizance should be taken of other considerations for stability in a community, such as:

- the demands of organisms for raw material (matter), and
- interrelationships (not to be discussed in this paper).

Very few practical ideas, in literature, were evident, for use in a laboratory situation. Many of the energy budget experiments were conducted by experienced researchers, using techniques of an involved and long term duration, coupled to statistical analysis, thus placing the activity out of reach of the pupil, who then has to contend with a theoretical explanation of the concept.

Smith (1980) discusses research conducted by Smalley (1960) on grasshoppers, Golley (1960) & Smith (1962) on mice and Whittaker & Likens (1973) on world ecosystems, amongst others.

Models of energy flow were established by Weigert & Owen (1971) in Smith (1980), as well as energy formulations to calculate energy efficiency.

Since the section on energy is generally regarded as theoretical, an investigation into a possible practical approach could alleviate this misconception of difficulty, assisting towards understanding and conceptualizing energy concepts, with a view to making the teaching and learning outcomes more efficient.

## ENERGY FLOW

4.2 THE STATUS OF ENERGY FLOW IN POPULATION DYNAMICS

An analysis of ENERGY FLOW as prescribed for the current standard ten Biology syllabus could serve as a guide and an example (being one of the less popular topics of Population Dynamics - See Figure 4) towards interpreting the reorientation and restructuring mechanism that could be employed for any of the other topics of Population Dynamics.

The syllabus requirement for Energy Flow in both Higher Grade and Standard Grade Biology syllabuses reads as follows:

TABLE 5: SYLLABUS EXTRACT

SYLLABUS CONTENT	ELABORATION	PRACTICAL WORK
7.5 Energy flow	Parameters of Energy Budget (consumption, production, faeces, respiration and excretion.	

[Dept. Ed. & Culture, Vol. 9 Education Bulletin HG & SG  
1986 SS9'/86 & SS10/86]

## ENERGY FLOW

**NOTE:** No suggestions appear for practical or evaluative activities and the tendency is to present this topic in a theoretical, academic manner, hence the poor attitude to energy topics.

An analysis of South African Biology Standard Ten textbooks (Table 3) revealed that only 1,1% to 6,5% of the Population Dynamics section were allocated to Energy Flow, with scant provision for appropriate practical suggestions in support of the theoretical concepts.

In addition the quality of textbook information ranges from the simplistic (Ayerst et.al. 1988) to the technical (Smit et.al. 1988), therefore, the lack of innovation in the presentation of material on Energy Flow may account for the perceived apathy shown by respondents to the concept of energy.

**TABLE 3: ANALYSIS OF THE ENERGY TOPIC OF POPULATION DYNAMICS IN STD. 10 SOUTH AFRICAN BIOLOGY TEXTBOOKS.**

TEXTBOOK	NUMBER OF PAGES ON ENERGY	TASKS ON ENERGY	DIAGRAMS ON ENERGY	NUMBER OF PAGES ON POPULATION DYNAMICS	% PAGES ON ENERGY CONCEPTS
BIOLOGY 10 CLASSENS (1988)	2	0	3	31	6.5
EXPLORING BIOLOGY AYERST (1988)	2	0	1	168	1.1
SENIOR BIOLOGY 10 SMIT et. al. (1987)	5	0	3	163	3.1

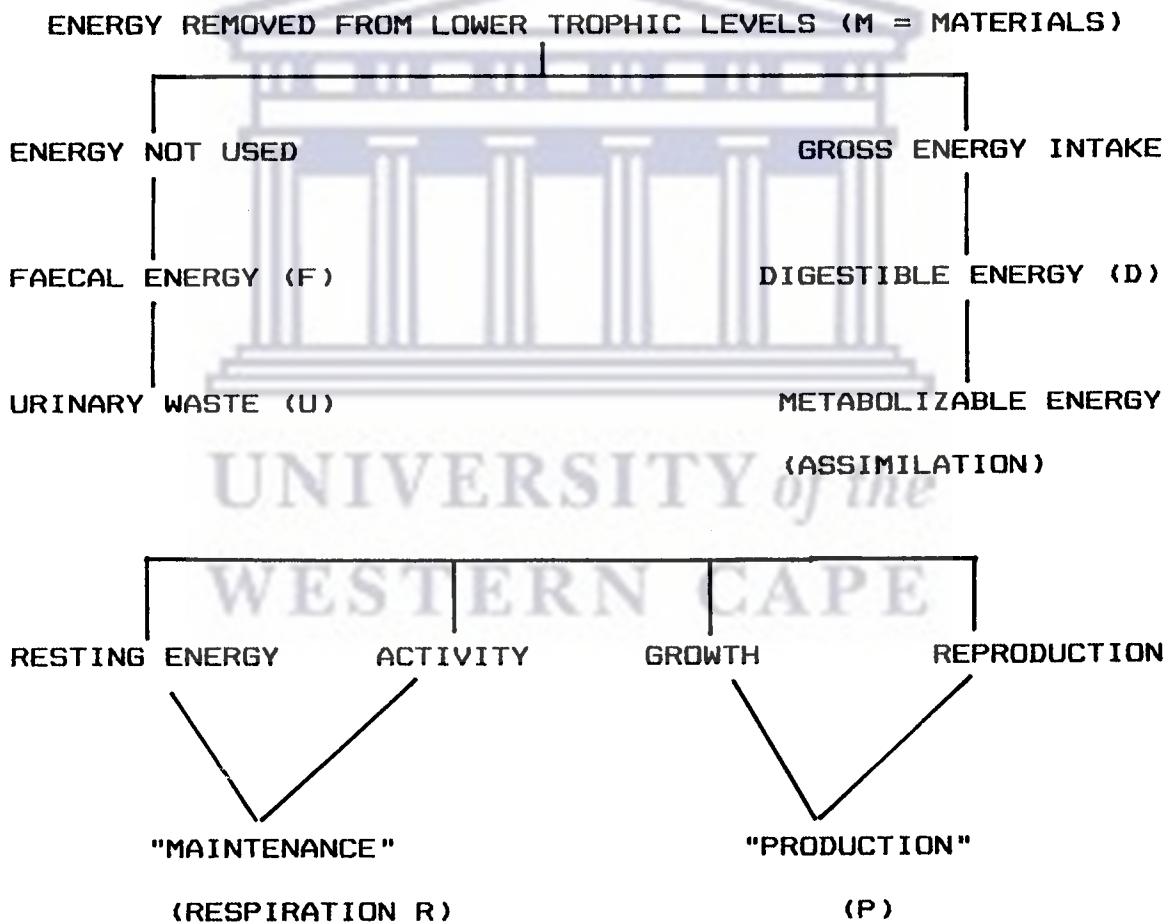
**ENERGY FLOW**

Final biology exam questions for standard Ten based on energy (Table 4) were in the region of 17% (1988) and 12,5% (1990) of the Higher Grade Population Dynamics section, with no questions on energy being formulated for the 1989 Higher Grade Biology and Standard Grade Biology papers (1988, 1989, and 1990) supporting the view that **Energy Flow** are underexposed and devalued. The problem facing Biology teachers are, how to adapt the highly academic research papers into a language and skills mode that can easily be understood, assimilated and applied to local conditions.

On the other hand should one not investigate local conditions with a view to developing readily accessible examples of Energy Flow that will match the pupils school experience with that of their local rural and/or urban locality. Kormondy (1984) agrees that the type of information required to construct an Energy Flow diagram for any ecosystem is extremely difficult to obtain because of the many external parameters that need to be assessed simultaneously as well as variables in the material (for example, different rates of photosynthesis in plants and different rates of metabolism in animals). He points out that "unless an ecosystem is supplied with energy either in the form of sunlight or organic matter from another photosynthesis dominated ecosystem, the system will collapse".

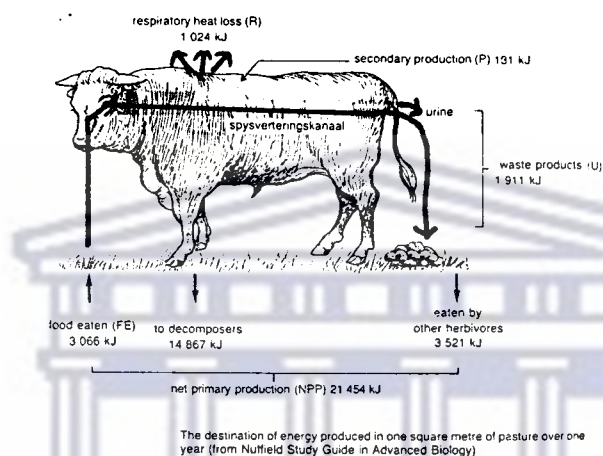
ENERGY FLOW

The progressive partial loss of energy in the form of heat as well as transference of energy through trophic levels should clearly be illustrated by means of a simple diagram as drawn by Krebs (1985), where the fate of the energy and materials captured in primary pool activity is shown by looking at the metabolism of an individual herbivore.



## ENERGY FLOW

This simple Concept Map could serve as a focal point for use in classroom practicals by linking actual examples such as the herbivorous garden snail to this pattern, or a visual of a cow as illustrated in Smit et. al. (1988).



### 4.3 A RESOURCE SUGGESTION ON ENERGY FLOW STUDY

In a book entitled "Biology in Daily life" (Olejnik 1988) the author compiled magazine and newspaper clippings covering various biology topics. A similar collection could be made of numerous articles with an energy focus, matched to stimulating questions for classroom work.

#### 4.3.1 CASE STUDY: APPLICATION OF AN ENERGY ARTICLE AT A SPRING SCHOOL.

In September 1991, NECC sponsored the matriculation Spring School for DET (Dept. of Education and Training) Standard Ten pupils at the Academy for Learning, Guguletu, Cape Town.



**ENERGY FLOW**

Biology was offered as one of the courses, with Population Dynamics as a component topic to be presented. I was consequently approached to assist in this programme.

The class consisted of 31 pupils and the time allocated for Population Dynamics were 2 x 2 - hour slots.

An initial survey before the commencement of the Population Dynamics slots revealed the following:

- \* only eight pupils were previously exposed to this section of the work.
- \* problems were encountered with terminology.
- \* practical exercises enjoyed more favourable responses than lectures.
- \* lecture method seemed threatening and pupils were content to wait for the handouts rather than taking any notes.
- \* that Population Dynamics was left for the tail-end of the course with no time allocated for field-work
- \* that Population Dynamics has more meaning if it is linked to the problems and experiences of their own environment, such as squatters, impoverishment, unemployment, gangsterism, water and food resources, health, group areas etc.

## ENERGY FLOW

The article selected for validation of the resource material approach was entitled;

"WHY CONSERVE"

Paul Ehrlich, a population geneticist from Stanford University, California, has authored more than 30 books and 500 papers. His writing has had a profound influence on environmental policy around the world. He recently presented the keynote address entitled "Extinction" as well as a popular lecture at the national conference on the Conservation of Biotic Diversity convened at UCT by the CSIR's Foundation for Research Development, where he addressed the basic arguments for the conservation of biotic diversity. Tisha Greyling, Liaison Officer (Terrestrial Ecosystems) in the FRD office at UCT, summarised his two talks.



Dr Ehrlich

## Why conserve?

Why conserve? This thorny question often catches the unprepared off-guard. How do you explain in a few concise statements to the hardy non-conservationist the reason for conservation? Professor Paul Ehrlich, one of the world's most articulate scientists in the field of environmental studies, recently answered this question at UCT.

### Aesthetics and ethics

People of all cultures have an aesthetic interest in nature. People like green things, that is why they garden. There are strong animal-rights movements across the world, illustrating human compassion in our society. A single example of people's love of and interest in nature is birdwatching. There are more than 60 million birdwatchers in the USA alone. And in England, more people go birdwatching than attend soccer matches!

The major ethical argument is that *Homo sapiens*, humankind, is the dominant species on Planet Earth. We have, therefore, a responsibility towards other living things.

### Economic benefits

Hutchinson's Disease was incurable until a plant was discovered in Madagascar which contained two compounds that cure not only this disease, but are beneficial in treating certain lymphomas and leukemias. These compounds are currently the basis of a \$80 million industry, not counting the amount saved by prevention of these diseases.

One third of all active ingredients in medicines is based on plants – and that with only two percent of all flowering plants ever having been investigated for similar ingredients! There is a huge potential in the gigantic reservoir of plant reserves in the world, which are unfortunately being destroyed faster than they can be studied.

Economic benefits from the timber industry alone are countless; timber is used in building, for furniture, as props in mines, to make paper; and most of the third world depends on timber as a fuel.

### Food supply

Today, there are three grasses which supply the world with the major proportion of its food supply: wheat, rice and maize. If one of the three major food sources should for some reason "crash" (for example, we know that some strains of wheat have a lifespan of only eight years) we shall run into serious problems. There is a vast potential in plants to develop new crops. Approximately 250 to 300 species are potential sources of important foods.

### Over-population

Why, then, are things moving in the wrong direction? Data indicate that about 40 percent of basic plant resources (excluding aquatic systems) are currently being used or destroyed by *Homo sapiens*. This is alarming. The single greatest problem on earth is population growth,

coupled with related problems of war, racial and religious prejudices, environmental abuse, and so on.

Humanity has been on earth for about four million years. In 1939 there were two billion people in earth, in 1988 there are 5,1 billion. Therefore, three billion people have been added in just short of 50 years, which is more than we added in the previous four million years! Our present increase is 84 million each year – equivalent to a new South Africa every six months.

Although the rate of growth has slowed down in recent years because of, for example, strict population control in China, the actual increase in numbers is greater than ever before.

There is an enormous momentum built into population growth. If the average family size in India should drop today from 4,5 members to 2,2 the Indian population would still continue to grow for another century before it would stabilize.

The main impact of the high population growth in poor countries is that it prevents them from ever saving enough to better their own condition. Kenya's population will double in 35 years. Kenya will, therefore, in the next three decades have to double every single facility such as roads, agriculture and medical support.

## ENERGY FLOW

"At the present rate resources that  
took millenia to accumulate could  
last a few centuries"

**Environmental impact**

We are using Earth's resources faster than they can be replaced. At best, at the present rate the available resources could last a few centuries – resources that took millenia to accumulate.

A major problem is the concept of our economic structure: if the yield from a resource is insufficient to satisfy the economic requirements, we use the capital as well. When all is spent, we move on to a new resource. Therefore, when all the whales in the ocean have been killed and are a depleted resource, a new resource will be found. And whales will be extinct.

Developed countries have a much more severe per capita impact on the environment than undeveloped countries. One American has 60 times the impact than one Burmese. The major impacts on the environment such as severe plastic pollution, refrigerants and aerosol propellants, air pollutants and a host of others, are the by-products of a first-world society.

**Critical resources**

The world's most critical resources are:

- topsoil, which took millenia to generate, and only decades to be depleted. Soil is a very complex system, not just crushed up rock, and is the single most under-appreciated part of our planet.
  - groundwater, which is being used faster than it can be recharged, and being polluted at an alarming rate. If there is no water, no "miracle" crops can save us. They are mostly fertilizer-sensitive and highly water-demanding.
  - the organisms other than *Homo sapiens*, i.e. about 30 million known species of plants and animals which form our resource base for potential food supply, maintenance of ecosystems, climate, soils, etc.
- One probable result of human impact on earth, even without a nuclear war, is climatic change on a global scale which would cause large-scale agricultural and other disasters, and would result in famine on a scale hitherto unknown.

**What are the solutions?**

- Start controlling population growth. Even if we should stop it today, it would take hundreds of years to grind to a halt, enough time for future generations to determine the ultimate sustainable size of the world's population.
- Change our current growth-oriented economy into a sustainable economy. Some of the young economists of the '80s are already moving in this direction.
- Change our education system to include concepts of ecology and evolution. Without a knowledge of complex biological processes we cannot take major decisions about our own future.
- Improve the position of women in terms of social standing, education, etc. because awareness on the part of women leads to a few healthy children rather than many unhealthy children.
- Do not wait for politicians to make the necessary changes. Make your own contribution in the meantime by setting aside a proportion of your time to help make your own society work better.

**Note:**

After reading the above extract, answer the following questions.

1. List at least FIVE energy - rich sources mentioned.
2. Draw a graph of Population Growth in billions, from 1939 to 1988.

Will available resources be able to support this population, explain?

3. Suggest a project or hint to save energy in your home.

**ENERGY FLOW**

The article on "WHY CONSERVE" was chosen for the holistic view presented of factors, such as food supply, over-population and critical resources amongst others, that impacts on the environment.

In addition, solutions to the environmental problems are broadly based encompassing population growth, sustainable economic growth, education and community action.

Furthermore Question (1) was formulated to see whether students had a stereotype view of energy, such as oil, wood and sunlight amongst others or could they recognize soil, water and organisms as suppliers of energy.

The graph of population growth as requested in Question (2) was intended to be a simple illustration of the rapid increase of people in a short space of time. An assumption was made that all the standard ten pupils had the necessary skill to interpret and project data visually and then to extrapolate the given result into their relevant experiences of South African conditions.

An attempt was made with Question (3) to internalize the ENERGY concept, by crossing the barrier between something happening outside of the pupils parameters to the home where the practicalities of Energy Conservation has immediate benefit for the individual and his/her family.

## ENERGY FLOW

The information contained in this article could also serve as a project for Concept Mapping (Novak 1991), an educational tool whereby students and teachers alike can organize and present knowledge in terms of their own frame of references.

Briscoe & La Master (1991) states:

".... as teachers, we hope that students will learn science concepts to solving real problems. Yet many college students would admit that they are unable to remember concepts past the final examination and do not connect science concepts to life experiences".

Mason (1992) is of the opinion that concept mapping leads to participants engaging in discussions through debriefing sessions thus clearing any misconceptions arising and favouring a better understanding of key concepts.



## ENERGY FLOW

4.3.2 FINDINGS BASED ON THE APPLICATION OF THE ARTICLE

Responses to the article were generally weak due to the following observable factors:

- Pupils were at a disadvantage with respect to reading with understanding because English was a Second Language, an African language being their mother - tongue.
- An assumption was made that they could switch between data information and graphical compilation, when many lacked these skills. Only three pupils (9,6%) out of thirty - one, produced graphs.
- They also experienced difficulty in expressing themselves verbally and in writing, but fared much better with the project question. Some of the answers reflected actual practices in the home, for example, one respondent explained that his father had welded hollow pipes to the chimney of the coalstove which was led to an outside room for heat, thus saving on electricity bills especially in winter. Another family used the maize cobs as fuel with most pupils suggesting alternatives, such as candles, lamps and insulating materials for conserving heat and saving electricity.



## ENERGY FLOW

- Clearly pupils related easiest to the needs that influences their survival and this sustainable aspect should be the basis on which any new environmental programme is developed.
- The inadequacies in the administration of this pilot test of the energy article were caused by a time constraint of one hour, no prior knowledge assessment of the pupils level of exposure to the concept of energy and no follow - up procedure such as a post - test.
- The correct procedure to follow would be to administer the article with reformulated questions to a selected sample of pupils from the same environs as the Spring School group. On the basis of these results obtained conduct a series of workshops could be conducted by utilizing one or two practical activities, interpreting and discussing the article, as well as Concept Mapping, before administering the post-test in order to evaluate any observable improvement in the pupils ability to conceptualize the relevance between academic school work and the political, social, cultural, economic and religious spheres of the environment.

This article as a teaching medium lends itself to group work and stimulates discussion, which can be used as a point of departure for remedial work in areas of weakness.

## CHAPTER FIVE: REVIEW AND CONCLUSION

This investigation into the PERCEPTIONS OF POPULATION DYNAMICS by students revealed the following:

(1) A subject of this magnitude forms an integral part of the pupils gestalt by bonding closer with behavior patterns of man in the environment.

(2) Pupils display little insight into the relevance of population studies for daily life (socio-cultural, political and economic spheres).

(3) Pupils are short-changed as far as environmental awareness is concerned because of:

3.1 non-practical teaching methods

3.2 lack of facilities

3.3 time constraints

3.4 lack of enough in-service training

3.5 textbooks, syllabuses and examination papers

encourage a regurgitation of factual material on energy topics, with scant regard for stimulation and interpretation of activities.

**CONCLUSION**

- 3.6 lack of resource material to supplement the theory.
  - 3.7 lack of insight by curriculum planners as to actual needs and concerns of pupils and teachers.
  - 3.8 a need for curriculum research and design around core environmental issues rather than an approach from a definition/theoretical viewpoint.
- (4) Adams(1990) suggests a Biology curriculum centering around natural resource ecology. His aims are as follows:
- 4.1 centering on the whole organism and ecosystem approach.
  - 4.2 giving students opportunities to investigate bio-social problems related to the maintenance of life-sustaining ecosystems and their own survival.
  - 4.3 enhancing student interest in further study of biology.
  - 4.4 puts the study of biology in the context of daily life-experiences.
  - 4.5 uses activity-based learning as the dominant form of instruction.

## CONCLUSION

From the investigation and evidence as presented, Population Dynamics as a continuation of the ecological concepts presented to pupils at standard eight level has failed to achieve the desired awareness and sensitization to environmental concerns in the sample being evaluated.

The scenario becomes more disturbing when one realizes that this sample represents prospective teachers who will be responsible for moulding primary pupils cognitive and aesthetic skills and who are supposed to create learning situations across the curriculum.

Population Dynamics can be used as a powerful tool to improve and conceptualize a positive environmental view, provided a restructuring of perception can be encouraged.

One is therefore not arguing for an exclusion of Population Dynamics from the Biology Syllabus, but rather an intensification of efforts to incorporate these concepts across the curriculum, not to be seen as the domain of any one specific subject.

In essence, for any measure of success to be gained from this proposed exercise, one would need to move away from the "expert, top down, I-know-whats-good-for-you approach", to a realistic needs analysis with the people concerned. The call is therefore for a democratization of the environmental education theme.

**CONCLUSION**

This philosophy formed the basis for this investigation by soliciting responses from the people in the field.

The need for this democratization process can be supported by the following factors:

- \* an acute awareness by First Year College students of the inadequacies of the Ecology topics at High School level
- \* the necessity of developing an environmental ethos at Primary School level
- \* the opportunity of designing a curriculum to fulfill the needs of prospective Primary School teachers, from the point of inception, with the skills needed to manage environmental material in a stimulating and practical manner

As a point of departure, Academic Support Programmes (ASP) could be established at central venues, eg. College of Education institutions, providing workshops to assist students in acquiring an environmental ethos. One such organization, active in the field is E.E.A.S.A (SHARENET) who are initiating such workshops.

## CONCLUSION

Since the role of professional teaching studies is intended to prepare the student to view teaching as a holistic activity, as an extension of the real world, experienced by the learner and empowering the learner to cope with this reality, an early assessment of students environmental perception at First Year College level, will assist in planning environmental programmes that will help in linking knowledge acquisition (content) more closely to knowledge transference (methodology).

Students in training need to realize the need to integrate academic content acquisition and reasoning on the one hand, with the practical implementation thereof on the other, in case one is being accused of perpetuating a system geared towards a certificate exam.

Present school courses are geared academically towards passing the Matriculation Examination. As time for study in standard ten remains at a premium, much emphasis is placed on theoretical approaches, with the demise of practical applications.



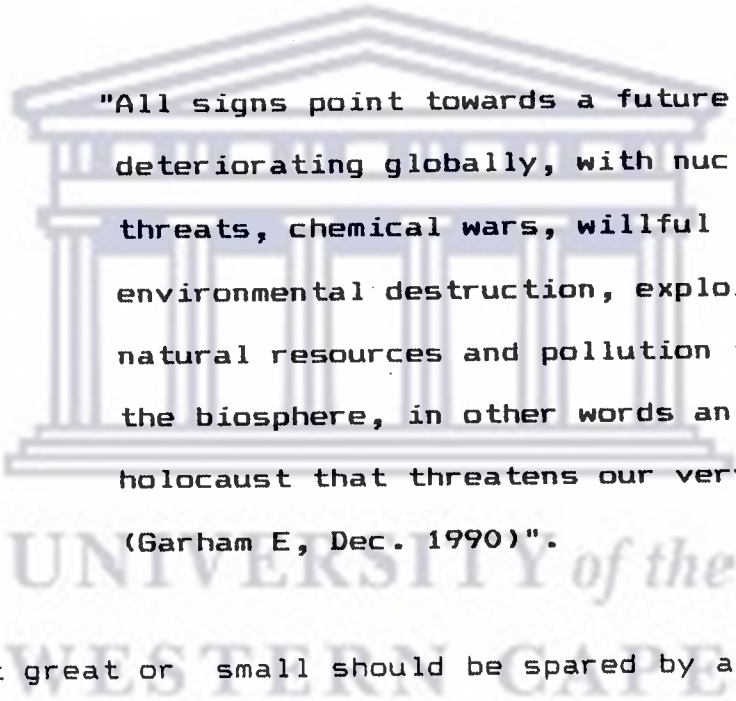
## CONCLUSION

Students entering Colleges of Education, therefore need reorientation away from the academic towards a methodological approach. Present College Syllabuses are arranged as modules: MODULE ONE being a CONTENT MODULE and MODULE TWO being a DIDACTICS MODULE, with lecturers tending to place more emphasis on the content component because of the volume of work contained therein, thus neglecting methodology, instead of working towards an integration of the two modules. This area of interpretation of the Biology college syllabus in curriculum development, presents another area of investigation outside the scope of this study.

Mention of this facet is opportune in order to support the notion that an ASP programme could serve as a bridging exercise for First Year Science students, by starting with their known exposure to Population Dynamics and linking up with Environmental Education as proposed by the White Paper on E.E. (1989), which also contains much of the international concepts of Environmental Education for a safe future.

**CONCLUSION**

The challenge facing schools, colleges and universities in the field of ecology is exciting because it (ecology) bridges the gap between pure sciences (physics, chemistry, biology, technology) to the social sciences, which is by far the most complex and unpredictable.



"All signs point towards a future that is deteriorating globally, with nuclear war threats, chemical wars, willful environmental destruction, exploitation of natural resources and pollution that poison the biosphere, in other words an ecological holocaust that threatens our very existence (Garham E, Dec. 1990)".

No effort great or small should be spared by all educators, to instill a love, appreciation and conservation ethic in our pupils, students, teachers and the community. Teachers should empower themselves to constantly and actively expand the intellectual space of their charges.

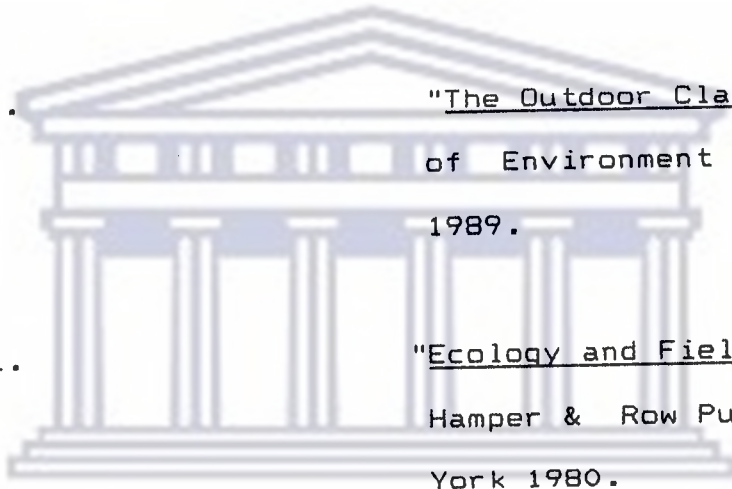
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# A P P E N D I X    A

1. TABLE 2: GENERAL PROBE FREQUENCY
2. LESSON METHOD ANALYSIS RESPONSE SHEET



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# APPENDIX A

Table 2  
General Probe: Awareness Levels

<u>(YES) FREQUENCY %</u>	<u>(NO) FREQUENCY %</u>
1. 89.8	10.2
2. 36.8	63.2
3. 6.5	93.5
4. 37.2	62.8
5. 94.2	5.8
6. 22.9	77.1
7. 4.0	96.0
8. 76.4	23.6
9. 84.0	16.0
10. 80.4	19.6
11. 51.7	48.3
12. 84.9	15.1
13. 77.9	22.1
14. 96.0	4.0
15. 49.1	50.9

LESSON METHOD ANALYSIS  
FREQUENCY OF RESPONSES

APPENDIX A

Syllabus Content	PRACTICALS	WORKSHEETS	LECTURES	SELF-STUDY	TUTORIAL	FIELD STUDY
	16	17	18	19	20	21
A. Population parameters (size, growth, mortality, reproduction, immigration)	24	27	66	16	10	3
B. Population growth (graphs)	22	43	59	18	9	1
C. Estimation of population size.	18	35	74	17	13	1
D. Population regulation (carrying capacity)	12	27	78	11	8	1
E. Density dependent and density-independent parameters.	9	23	83	13	13	1
F. Competition	4	25	77	24	7	5
G. Predation	3	24	77	21	10	5
H. Energy flow	11	22	80	17	8	6
I. Survival strategies (identifying and and attempts at solving the problems facing mankind)	13	17	74	20	14	4
	116	243	667	157	92	27

**APPENDIX B**

**ENGLISH AND AFRIKAANS QUESTIONNAIRE**



**UNIVERSITY *of the***  
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RESEARCH QUESTIONNAIRE: ECOLOGICAL AWARENESS OF FIRST YEAR STUDENTS AT A TERTIARY INSTITUTION

COMPILED AND CONDUCTED BY K.R.LANGENHOVEN FOR M.PHIL. (BOTANY) DEGREE AT UWC (1990)

We are trying to find ways and means of making a study of ECOLOGY more relevant and interesting. Your honest response to the following questionnaire will assist us in determining the relevance or otherwise of specific units of ecology that is presently being offered as part of the biology course at matriculation level.

This questionnaire will assist in identifying some problem areas in the study of population dynamics. New approaches can be developed that will assist pupils and teachers to acquire a better understanding of the importance of this topic and it's impact on the survival of mankind.

Answer the following questionnaire as honestly as you can by following the instructions for each section.

- \* There are FIVE sections to be completed.
  
- \* The sequence of test items has been randomised.

SECTION A: STUDENT INFORMATION

Please provide the following information.

1. Town where you last attended school. \_\_\_\_\_
2. Year of matriculation. \_\_\_\_\_
3. Biology symbol in matriculation exam. \_\_\_\_\_
4. Level at which biology was offered. \_\_\_\_\_
5. Sex \_\_\_\_\_
6. Age \_\_\_\_\_
7. Home Language \_\_\_\_\_





SECTION B: GENERAL PROBE

- \* You must answer every item.
- \* Circle the answer of your choice

- |  |     |    |
|--|-----|----|
| 1. Did you enjoy biology lessons?  | Yes | No |
| 2. Do you think that the practical work component of the biology course was sufficient for the year (1989)?      | Yes | No |
| 3. Did you experience an organised field trip with your Std. 10 class?   | Yes | No |
| 4. Do you regard the problem of pollution as one to be solved by the Nature Conservation Department?             | Yes | No |
| 5. Would you have preferred more practical work on the population dynamics topic?                                | Yes | No |
| 6. Are you a member of a hiking, mountaineering or outdoor club?   | Yes | No |
| 7. Would you have preferred less practical work on the population dynamics topic?                                | Yes | No |
| 8. Did you find that the graphical illustrations on population dynamics helped your understanding of this topic? | Yes | No |
| 9. Do you feel that a study of population dynamics has influenced your view of ecology?                          | Yes | No |
| 10. Do you think that Primary School pupils need more exposure to ecology than Secondary School pupils?          | Yes | No |
| 11. Is there a difference between population dynamics and ecology?   | Yes | No |

12. Did you answer the questions based on population dynamics? Yes No
13. Do you enjoy watching television programmes on ecology? Yes No
14. Would you have preferred more exposure to ecological concepts in the Std. 10 course work? Yes No
15. Did you find that the ecological study at Std. 8 level facilitated your understanding of population dynamics? Yes No

THANK YOU FOR YOUR CO-OPERATION, PLEASE PROCEED TO SECTION C



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SECTION C: KEY TO LESSON METHODS

- \* Read the following definitions of lesson methods and fill in the table on LESSON METHODS ANALYSIS by ticking the appropriate block of your choice.

DEFINITIONS

16. PRACTICALS  
Active group or individual experimentation in a laboratory.
17. WORKSHEET  
An activity sheet providing a preamble to the lesson topic, as well as a mechanism to facilitate data collection through observation, as a supplement to field trips and practicals.
18. LECTURES  
Formal dictation and/or discussion of topic.
19. SELF-STUDY  
Handouts with references and scope of work to be studied for examinations. No formal lecture is delivered on the topic under consideration.
20. TUTORIAL  
Handout with sample questions for later group discussions.
21. FIELD STUDY  
An outdoor investigation of an area of the environment with a view to data collection, sample collection and observation of relationships of plants, animals and the environment.

PLEASE TURN TO THE NEXT PAGE FOR THE LESSON METHODS ANALYSIS TABLE

SECTION C: LESSON METHODS ANALYSIS TABLE

\* Please indicate by means of a TICK ✓ the method used by your biology teacher to consolidate the following aspects of population dynamics.

\* You may indicate more than one method per topic.

Syllabus Content	PRACTICALS 16	WORKSHEETS 17	LECTURES 18	SELF-STUDY 19	TUTORIAL 20	FIELD STUDY 21
A. Population parameters (size, growth, mortality, reproduction, immigration)						
B. Population growth (graphs)						
C. Estimation of population size.						
D. Population regulation (carrying capacity)						
E. Density dependent and density-independent parameters.						
F. Competition						
G. Predation						
H. Energy flow						
I. Survival strategies (identifying and attempts at solving the problems facing mankind)						

SECTION D: YOUR PREFERENCES

22. Consider the aspects of population dynamics mentioned in SECTION C, and write down the letter only, of those aspects that you found most interesting and stimulating.

ANSWER: \_\_\_\_\_

23. Consider the aspects of population dynamics mentioned in SECTION C, and write down the letter only, of those aspects that you found boring.

ANSWER: \_\_\_\_\_

24. How much time (in weeks) did your biology teacher allocate to population dynamics?

ANSWER: \_\_\_\_\_

25. Choose ONE aspect of population dynamics, that in your opinion has the most relevance to the survival of mankind.

ANSWER: \_\_\_\_\_

26. Give reasons for your choice in question 25.

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27. Name ONE television programme dealing with ecology.

ANSWER: \_\_\_\_\_

28. Name ONE environmental or ecology magazine that you have read recently.

ANSWER: \_\_\_\_\_

29. Mention ONE area in your vicinity that is heavily polluted.

ANSWER: \_\_\_\_\_

PLEASE TURN TO SECTION E

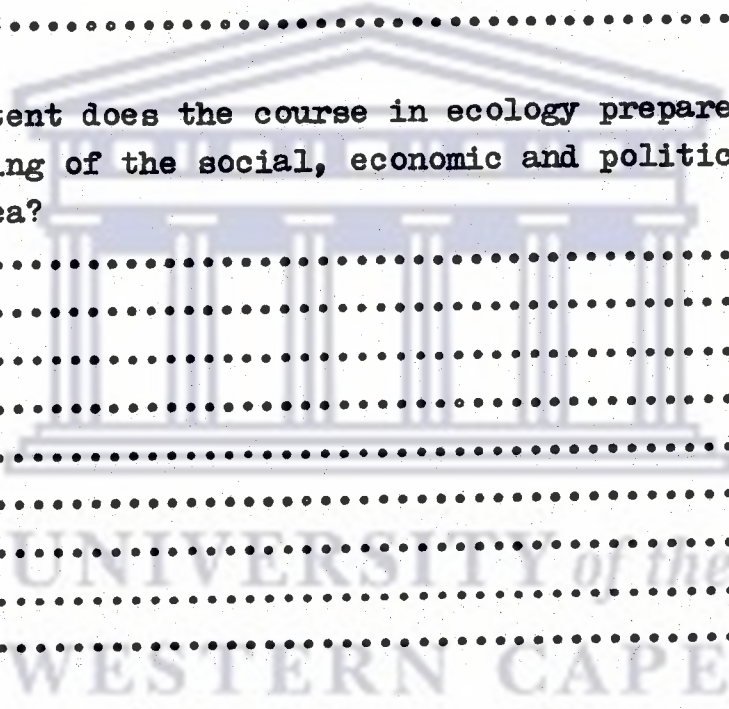
SECTION E: YOUR PERSONAL OPINION

30. What would you expect from an ecology course at University or College of Education?

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31. To what extent does the course in ecology prepare you for an understanding of the social, economic and political life of South Africa?

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THANK YOU FOR YOUR CO-OPERATION



NAVORSING VRAELYS: EKOLOGIESE BEWUSTHEID VAN EERSTE JAAR STUDENTE  
OP 'n TERSIÈRE INRIGTING

SAAMGESTEL EN UITGEVOER DEUR K.R.LANGENHOVEN VIR DIE GRAAD  
M.PHIL (PLANTKUNDE), UWK (1990)

Ons poog om maniere te vind om die studie van die Ekologie meer relevant en interessant te maak. U eerlike respons op die vraelys sal ons help om die relevansie of nie van spesifieke eenhede van die ekologie wat tans deel uitmaak van die matriek biologie sillabus, te beoordeel.

Die vraelys sal help om sekere probleem areas in die studie van bevolkingsdinamieka, te identifiseer. Nuwe benaderings kan bedink word wat onderwysers en leerlinge sal help om 'n beter insig van die belangrikheid van die onderwerp te verkry en die impak daarvan op die voortbestaan van die mensdom.

Beantwoord die volgende vrae so eerlik moontlik deur die instuksies vir elke afdeling noukeurig te volg.

\* Daar is VYF afdelings.

\* Hierdie vraelys is vertroulik.



AFDELING A: STUDENTE INLIGTING

Verskaf asseblief die volgende inligting.

1. Dorp of stad waar u laaste skool bygewoon het. \_\_\_\_\_
2. Jaar van matrikulاسie. \_\_\_\_\_
3. Biologie simbool in matrikulاسie eksamen. \_\_\_\_\_
4. Vlak waarop u biologie aangebied was. \_\_\_\_\_
5. Geslag. \_\_\_\_\_
6. Ouderdom. \_\_\_\_\_ 7. Huistaal. \_\_\_\_\_

AFDELING B: ALGEMENE INSIG

\* U moet alle iteme beantwoord.

\* Trek n sirkel om die antwoord van u keuse.

- |   |    |     |
|---|----|-----|
| 1. Het u biologie lesse geniet?   | Ja | Nee |
| 2. Dink u dat die praktiese werk komponent van die biologie kurses genoegsaam was vir die jaar (1989)                     | Ja | Nee |
| 3. Het u ondervinding in n georganiseerde veld uitstap-<br>pie met u St. 10 klas opgedoen.                                | Ja | Nee |
| 4. Beskou u besoedeling as n probleem wat deur die<br>Natuurreservaat Departement opgelos moet word.                      | Ja | Nee |
| 5. Sal u meer praktiese werk oor bevolkings dinamiek<br>verlang het?  | Ja | Nee |
| 6. Is u n lid van n bergklim klub of n natuurliefhebbers<br>klub?   | Ja | Nee |
| 7. Sal u minder praktiese werk oor bevolkings dinamiek<br>verlang het?  | Ja | Nee |
| 8. Het die grafiese voorstellings oor bevolkings dinamiek<br>u insig oor hierdie onderwerp beïnvloed?                     | Ja | Nee |
| 9. Voel u dat n studie van bevolkings dinamiek u begrip<br>van ekologie beïnvloed het?                                    | Ja | Nee |
| 10. Dink u dat Primêreskool leerlinge meer blootstelling<br>aan ekologie moet verkry teenoor Sekondêreskool<br>leerlinge? | Ja | Nee |
| 11. Is daar n verskil tussen bevolkings dinamiek en<br>ekologie?  | Ja | Nee |
| 12. Het u die vrae oor bevolkings dinamiek beantwoord?  | Ja | Nee |

13. Geniet u die SAUK se beeld materiaal oor ekologie? Ja Nee
14. Sal u meer blootstelling aan ekologiese beginsels in die St. 10 biologie kurses verlang het? Ja Nee
15. Het u gevind dat die ekologiese studie op St. 8 vlak u insig oor bevolkings dinamiek op St. 10 vlak verbeter het? Ja Nee

DANKIE VIR U SAMEWERKING, BLAAI NA AFDELING C



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AFDELING C: LESMETODES SLEUTEL

- \* Lees deur die volgende definisies van lesmetodes en vul in die tabel oor ONTLEDING VAN LESMETODES, deur 'n korrek teken ✓ in die blokkie van u keuse aan te bring.

DEFINISIES

16. TAKE  
Aktiewe groep of individueel eksperimenteering in 'n laboratorium.
17. WERKBLAAI  
'n Aktiwiteitsblaaie met 'n voorrede vir die onderwerp, sowel as 'n meganisme om data versameling te bespoedig deur waarneming, as 'n aanvulling vir buitelig uitstappies en take.
18. LESINGS  
Formele voorlees en/of bespreking van onderwerp.
19. SELF-STUDIE  
Opsommings met verwysings en omvang van werk wat bestudeer moet word vir die eksamens.
20. STUDIEKLAS  
Werkstuk met voorbeelde van eksamen vrae vir groep besprekings.
21. BUITELIGSTUDIE  
'n Buitelig ondersoek van 'n omgewings gebied met 'n oog vir die versameling van data, monsters asook waarnemings van verwantskappe tussen plante, diere en die omgewing.

BLAAI NA DIE VOLGENDE BLADSY VIR DIE ONTLEDING VAN LESMETODES TABEL.

AFDELING C: ONTLEDING VAN LESMETODE

\* Dui aan deur middel van die korrek teken ✓ die metode wat u biologie onderwyser gebruik het om die volgende aspekte van bevolkings dinamika te konsolideer.

\* U mag meer as een metode per onderwerp kies.

	TAKE	WERKBLAAIE	LESINGS	SELF-STUDIE	STUDIEKLAS	BUITELIGSTUDIE
Syllabus Inhoud	16	17	18	19	20	21
A. Bevolkings parameters (grootte, groei, sterfte, voortplanting, immigrasie)						
B. Bevolkingsgroei (grafieke)						
C. Skatting van bevolking. (grootte)						
D. Bevolkings regulasie (dravermoë)						
E. Densiteit afhanklikheid en densiteit onafhanklikheid.						
F. Kompetisie						
G. Predasie						
H. Energie-vloei						
I. Oorlewings strategieë (identifikasie en ondernemings om die probleme van die mensdom op te los)						

AFDELING D: U PREFERENSIE

22. Oorweeg daardie aspekte van bevolkings dinamika wat in AFDELING C verskyn, en skryf neer die letter alleenlik van daardie aspekte wat u die uiters interresant en gedagteprikkelend gevind het.

ANTWOORD: \_\_\_\_\_

23. Oorweeg daardie aspekte van bevolkings dinamika wat in AFDELING C verskyn, en skryf neer die letter alleenlik van daardie aspekte wat u uiters vervelend gevind het.

ANTWOORD: \_\_\_\_\_

24. Hoeveel tyd (in weke) het u biologie onderwyser aan bevolkings dinamika bestee?

ANTWOORD: \_\_\_\_\_

25. Kies EEN aspek van bevolkings dinamika, wat in u mening van uiters relevansie vir die voortbestaan van die mensdom is.

ANTWOORD: \_\_\_\_\_

26. Gee redes vir u keuse in Vraag 25.

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27. Noem EEN televisie program oor ekologie.

ANTWOORD: \_\_\_\_\_

28. Noem EEN omgewings of ekologie tydskrif wat u onlangs gelees het.

ANTWOORD: \_\_\_\_\_

29. Vermeld EEN area in u plaaslike gebied wat hewig besoedel is.

ANTWOORD: \_\_\_\_\_

BLAAI ASSEBLIEF NA AFDELING E



AFDELING E: U PERSOONLIKE MENING

30. Wat sal u van n ekologiese kurses op Universiteit of Onderwyskollege verwag?

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31. In hoeverre berei die ekologie kurses jou voor vir n begrip van die sosiale, politieke en ekonomiese leefwyse in Suid Afrika.

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DANKIE VIR U SAMEWERKING

# APPENDIX C

## RESPONSES TO QUESTION 25

25. Choose one aspect of population dynamics, that in your opinion has the most relevance to the survival of mankind.

ANSWER: F COMPETITION (2)

### RESPONSES:

1. Survival of the fittest leads to competition. Each person or animal for itself leads to independence and possibly success.
2. For mankind to survive, there has to be a form of competition between them e.g. Farmers will grow more food in order to sell i.e. make a profit.

ANSWER: G PREDATION (4)

1. Man dominates over all life on earth. He was given a brain of a high calibre to outwit & think for himself. Man therefore has the power to save mankind through his ideas.
2. Man is the dominant living organism on earth, if there was any predator that could conquer man then we would decrease in number. Also man can influence the survival rate of other animals, by becoming predators and killing other animals.
3. Predation is leading to the extinction of certain animal species eg. hunting. Many species have been wiped out and in this way it affects the various food chains.
4. You find out more about how animals survive and how they feed on each other to survive.

ANSWER: H ENERGY FLOW (3)

1. If food chains are broken or energy flow is stopped at one point, it influences the whole ecosystem causing imbalances.
2. It shows the different levels and forms in which energy is available to man.
3. Mankind is distroying the balance of nature by killing too many animals. The food-chain and thus the energy flow will lead to an imbalance in nature with disatrous effects to mankind.