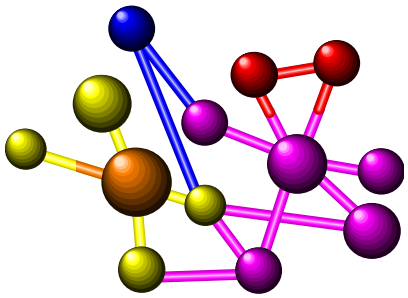
DEVELOPING ASPECTS OF ETHICS IN BIOLOGICAL EDUCATION FOR CARIBBEAN SCHOOLS



by

Winston K. King
University Of The West Indies
Faculty of Humanities and Education
School of Education
Cave Hill Campus
Barbados

DEVELOPING ASPECTS OF ETHICS IN BIOLOGICAL EDUCATION FOR CARIBBEAN SCHOOLS

Abstract

The paper begins by outlining the status of concepts in science and biological education at various levels of Caribbean education systems. By presenting a rationale for the teaching of ethics generally, and in biological education in particular, it makes the critical connection between what we **can** do and what we **should** do.

The paper describes how such a linkage may be initiated and developed, exploring as well the likely obstacles presented by the traditional, teacher-dominated way in which science in general, and biology in particular is taught in Caribbean schools.

There are several teaching strategies suggested as well as a sample of topics through which the ethical aspects may be introduced. Finally, there are some suggestions on the way ethical aspects may be assessed, concluding that perhaps, the ultimate assessment is how students' life styles and future behaviours are impacted.

INTRODUCTION

It is true to say that at present biological education in the Caribbean pays no attention to aspects of ethics and citizenship. In the case of the latter, there are topics related to biological education and man's impact on the environment. However, the obvious linkage between this aspect and being a good citizen is never emphasized. There seems to be more attention to the cognitive aspects and precious little to the affective. This situation is not unique to the Caribbean.

Perhaps in looking at aspects of ethics and citizenship in biological education, one needs to be more interested in how biological education is used or abused, leaning towards how such knowledge is exemplified in changes in behaviour and modified life styles.

Timothy Goldsmith (1994) makes a case for biological education to move away from the 'positive side of the ledger' towards trying to 'identify major problems that continue to beset humankind'. He argues for us to examine carefully things like:

> *'The building of dams to control flooding has had devastating effects on fisheries around the world. The discharge of gases used in aerosols and as refridgerants is playing havoc with the ozone shield for reasons only understood after, and as a result of, the fact'.... One could readily extend this list of assaults on the environment, and each could be used in teaching about biology and our planet – the only home our children will ever know'. (p.10).*

Goldsmith is particular harsh on the disconnect between biological education and 'warefare and other forms of violence that humans inflict on each other', that he believes 'constitute one of the major political and social problems that we confront'. (p.11).

Peter Kelly (1994) struggles with the same dilemma as Goldsmith when he queries where we are heading in biological education. He asks the question thus:

> *'Why haven't we discussed parent education, adult education etc. if, what we want to see is an educated citizenry? (p.31).*

Kelly concludes that:

> *'We, as biology teachers, must deal with the interrelationship of biological sciences, social sciences and moral/ethical issues. This means reformation of our whole teaching structure ... Questions of bioethics relate to economic issues. We must try to teach students how to think about ethical issues, not just explore the issues themselves.' (p. 31).*

PREVAILING CONCEPTS IN BIOLOGICAL EDUCATION:
The Caribbean Situation

Several writers have researched the topic of what concepts are embedded in biological curricula from around the world. A sample of these concepts will exemplify the point that what is done represents, in large part, a disconnect between the discipline and social, economic and political aspects like ethics and citizenship.

But to bring the focus to the Caribbean, King (1994) looks at what basic biological concepts are taught at various levels of the system. He lists the following as concepts taught at the primary level: movement, senses and observation, health and safety, useful plants and animals, pollution and conservation, the body and how it works, food preservation, man and his environment, drugs – use and abuse.

At the 11-14 age range, biological concepts form part of an integrated science course. However, a leading two-volume textbook has the following topics that are of a biological nature.

Book 1

Detecting Our Environment – What is the environment? … Senses and stimuli … The eye and how it works … Focusing on near and far objects … Spectacles … Are two eyes better than one? … Seeing colors … Extending sight … Ultrasonics to aid the disabled … The ear structure and function … The human voice and how it works … Touch, smell and taste … Nerves and brain.

Support and Movement - Support in plants … Support of movement in animals … Stability … Support in water and air … Muscles … Animals and external skeletons … Soft-bodied invertebrates.

Animals, Plants and their Environment - The environment … Habitats and communities … Identifying animals … The physical and biological environment … Competition … A closer look at plants and animals in the school ground … Important features of the soil … The sandy seashore … A swamp … The big ecosystem … Pollution.

Food, Nutrition and Health - Food in the Caribbean … Why do we need food? … Types of food … Measuring energy from foods … A balanced diet … Digestion, absorption, enzymes … Comparing mammal's teeth … Caring for teeth … What makes teeth decay? … Why preserve food? … Bacteria and food spoilage … Fungi … Organisms and the

Book 2

Looking at Living Things – Sorting things out … The big difference between animals … Features of vertebrates … Similarity and variety … Looking at birds, mosquitoes, butterflies … Keeping invertebrates in the laboratory … Classifying plants … Looking at trees and flowers … Watching seeds grow … Seed dispersal.

Cells and Organisms – Looking into plant and animal cells … Cells and organisms.

Reproduction and Growth – Cell and reproduction … Sex cells in plants and animals … Animal embryos and their development … Plant embryos … Parental care.

Air and Living Things - The atmosphere (constituents and uses) … Breathing (exhaled and inhaled air) … Effects and exercise … Oxygen and cells … How do fish breathe? … Plants and foodmaking … Food chains and food webs.

Biology Education at the Senior Secondary Level (14-16)

The opinion has been expressed by several educators that biology teaching in schools in the Caribbean is greatly influenced and controlled by examination bodies and textbooks. At the 14-16 age range, students are being prepared for examinations which will give them a passport to the job market or further study in the subject. It is perilous to miss this boat.

In the last few years, the region developed its own secondary school-leaving examination capability - The Caribbean Examinations Council (CXC). Out of the activities of a group of biologists and biology educators has emerged a syllabus, which represents, or ought to represent, the latest thinking about biology education.

Those involved in biology education at all levels waited anxiously for a document that would make the study ecologically relevant to Caribbean peoples. With all due respect to external examination bodies, it was felt that this syllabus would remove all the concerns and imperfections about which everyone complained so bitterly.

Many of the concerns have been redressed, many fears allayed, but there seem to be certain aspects that need to be put right. There are definite attempts to follow some of the trends of international biology education, but a lot more needs to be done.

The CXC Biology Syllabus

The syllabus begins by providing a rationale for the study of biology. The case is made that biology is relevant to every individual and that there is a need to generate a concern for all life and develop an attitude of responsibility for the total environment. Biology also promotes an awareness of the dynamic nature of scientific ideas and an appreciation for the breadth of science.

From this rationale, the general goals of the syllabus are to:

- Develop an understanding of fundamental biological principles and concepts based upon practical and theoretical knowledge of living organisms.
- Develop a natural curiosity about living organisms without encouraging their unnecessary disturbance and/or destruction.
- Recognize the dynamic nature of the interrelationships between organisms and their environments.
- Recognize the social and economic implications of biology.
- Apply biological knowledge to everyday life situations.
- Make accurate observations of biological material and phenomena, both in the field and in the laboratory.
- Develop an ability to record information accurately by means of clear, labeled diagrams, graphs, tables, etc.
- Formulate hypotheses and design and carry out experiments to test them.
- Assess and interpret simple biological experiments and data.
- Develop and practice problem-solving skills.
- Develop an awareness that principles of chemistry, physics and mathematics are necessary for proper understanding of biology.
- Appreciate that, although generalizations have predictive value, there are often exceptions to them.
- Develop a respect for living things.

Explicit in these statements are some key biological concepts (e.g. the interrelationships between organisms and their environments, social and economic implications of biology, application of biological knowledge to everyday life, development an practice of problem-solving skills, and respect for living things and the environment).

The content areas are organized into five sections, each of which has subsections (as deduced from the specific objectives):

Section A – Living Organisms in the Environment … This section focuses on the diversity and similarly of form in living organisms, the interdependence between living organisms and their environment, energy flow through living organism within the ecosystem, and the recycling of substances in nature.

Sec*tion B* - Life Processes … This section contains the usual biology topics that may be considered the basic concepts of what is life, how it is perpetuated, etc. This is by far the largest and possibly the heaviest weighted section.

Section C - Continuity and Variation … Among the basic topics – like structure and function of cells, role of mitosis, and asexual and sexual reproduction – there are topics that seem to slant toward the use of biological knowledge for improved efficiency in agriculture and food production, such as mechanisms through which variations in organisms originate and are inherited and the importance of genetic variations in species.

Section D - Disease and Man … This section recognizes that several disease common in the Caribbean affect the quality of life of its people (e.g. venereal diseases and alcoholism), the efficiency of its human resources (e.g. deficiency, vector-borne and physiological diseases), and its economy (e.g. reducing agricultural production).

Section E – Environment and Man … This section focuses on the importance of soil to living organisms, ecology and the effects of man's activities on the environment, including an appreciation of the finite nature of the world's resources.

Emphasizing the importance of practical work and the scientist's approach to the task, the syllabus puts a section of "Practical Work" at the beginning. "The historical development of science shows that originally acceptable solutions are continually being modified in the light of new knowledge and new technology. No solution is final and infallible. What is important, therefore, for the students to acquire are the skills of problem-solving." (CXC Biology Syllabus, p. 8)

Topics in Popular Biology Textbooks at 16+

To complete the picture about topics in biology education in schools in the Caribbean, the author carried out an analysis of three of the more popular biology textbooks recommended and used in schools. The intention here was to identify some of the topics already outlined at the various levels of the school system, especially at the CXC (16+) level (see Table 1).

There seems to be a definite trend in the move away from merely descriptive biology in some textbooks. For example, the feeling about Textbook B is very sharply divided between two poles – one that feels that it has too many practically-oriented exercises and not enough "facts", and another that sees the practical orientation as being exactly what biology education is all about.

This author feels that the textbooks are still too slow towards reflecting international trend and some of the trends of the biology education profession. The trend towards the socio-cultural aspects of biology for everyday living are still being overlooked, and these need immediate redress.

Topics	Book A	Book B	Book C
Food & Nutrition	How animals feed: nutrition, carbohydrates, proteins, fats, vitamins, minerals, water, roughage. Balanced diet. Digestion. Teeth, the alimentary canal. Absorption. Heterotrophic nutrition. Parasites. How green plants feed.	Food classes. Energy value. Preparation preservation, poisoning.	Animals as food: diet and food. Plants as food. Preservation of food, spoilage, tests for substances. Energy in food substances, storage.
Health & Nutrition	Pathogens cause disease. Antibodies and immunity. Infectious diseases: Influenza, small-pox., tuberculosis, gonorrhea, AIDS.	Health and population. Statistics – life expectancy. Results of man's population growth. Air pollution. Pollution of seas, beaches and swamps. Conservation. Diseases and bacteria; viruses; protozoa and fungi; transmissions; population checks; deficiency; hereditary or genetic; physiological – diabetes and hypertension.	Health and disease; infectious disease; disease due to parasitic worms; fungal diseases; immunity to diseases; sexually transmitted diseases.
Agriculture	Soil – formation, components. Types of soil.	Agriculture and population growth. Soil: organisms, type, acidity and alkalinity, fertility. Conservation.	Soil: acidity and alkalinity; composition and formation; kinds of soil; water-logged soils. Soil conservation.
Environment & Environmental Conservation	Living organisms in the environment: energy relationships, studying ecosystems, man in the ecosystem.	Environment: pollution, conservation. Organisms in their environment: water, carbon, nitrogen, sulphur cycles; distribution and factors affecting it; methods of investigation; study of a single species. Food chains and webs. Population.	Man's effect on the environment; air; pollution; water and noise; land pollution; radiation. Man's long-term effects on the environment. Ecosystem.
Human Biology	Life processes.	Life processes.	Life processes.

TEACHING OF ETHICS IN SCIENCE CLASSROOMS:
The Present Position in the Caribbean

From the foregoing section on what are prevailing concepts in biological education in the Caribbean, it should be clear that ethical considerations are completely absent – at least from the list of topics. The methodology employed does not consider the matter either.

Research over the years has shown that the emphasis in the teaching of science has been the expository/lecture method. There is little or no attempt to teach for application of knowledge or for the development of scientific literacy.

King (1982) in categorizing primary school teachers' teaching style in science, found that most of them were 'informers' - relatively infrequent use of questions except those demanding recall and the application of facts, and principles to problem – closing.' These teachers showed a relatively high incidence of teachers' statements of fact, and teacher direction to fact finding. Consultation between pupils for purposes other than acquiring information was scarce.

The teaching style, designated in the literature as 'Enquirer' was rare. Enquirers usually show a very high incidence of five categories in pupil directed activities, and low incidence of all Teacher directed categories like 'Teacher ask questions which are answered by recalling facts and principles, or applying facts and principals to problem solving.'

He also found that although the curriculum under investigation, emphasized enquiry learning and other child-centered approaches, the teachers seemed more concerned with the dispensing of facts, despite their own relatively poor background in science.

Jones (1990) in attempting to develop an instrument to measure fifth form students' level of scientific literacy made some interesting discoveries. After validating the instruments, he measured the students of a rural secondary school in St. Vincent and the Grenadines on three scientific literacy scales:

1. Understanding of the Nature of Scientific knowledge;
2. Knowledge of basic concepts;
3. The ability to apply science concepts to everyday situations.

The randomly selected students were divided into three groups as follows:

Group 1:	Students doing Biology at fifth form.
Group 2:	Students doing neither Integrated Science nor Biology at fifth form
Group 3:	Students doing both Biology and Integrated Science in fifth form.

The findings suggest that students in Group 3 were more scientifically literate than students in Group 1 and 2. Students in Group 2 were less scientifically literate than students in Group 1

and 3. Students in Group 2 were less scientifically literate than students in Group 1, when considering performances on the three scales together. Group 3 performed significantly better than Group 1 and 2 on scale 1. Group 1 and 3 performed significantly better than Group 2 on scales 2 and 3. All groups performed highest on scale 2 and lowest on scale 3.

Jones explains the law finding thus:

> *'This may be seen as a reflection of the way in which science is taught in schools (secondary) in the St. Vincent and the Grenadines. Students are required in most cases to memorize a large number of facts and concepts in a meaningless way, with no connections made with their everyday situations.' (p.89).*

He concludes that science concepts should be taught in a meaningful context, being given many opportunities as possible to apply scientific knowledge in solving problems in everyday life. He emphasizes that students should be made to recognize the nature of scientific knowledge *'through (1) direct instruction and (2) approaches to the teaching of science concepts.'*

These findings show clearly that aspects of scientific literacy which directly impact on treatment of ethics were noticeably absent.

Johnson (1996), in a study of the level of scientific literacy in sixty-four (64) primary teachers in St. Vincent and the Grenadines, recognizes that the primary school is an important element I the attainment of scientific literacy. He posits the view that primary school teacher have *'a crucial role to play in the development of scientific literacy among their students.'*

Using questionnaires, interviews and observation schedules, Johnson's study revealed the following:

1. None of the teachers demonstrated a satisfactory level of scientific literacy.

2. Thirty three percent were marginally literate.

3. Marginally literate and less literate teachers admitted to both negative and positive attitudes to science teaching.

4. Marginally literate teachers were more inclined to engage pupils in practical work and provide opportunities for students to use science process skills.

5. Both marginally literate and less literate teachers displayed undesirable practices in science teaching.

At the secondary level, experience has shown that ethics, or should we say teachable ethical moments, are missed. Indeed, many teachers do not consider this area as important. We still teach science as if it were dogma, always keeping a watchful eye on the ubiquitous syllabus'

for external examinations. Perhaps some objective treatment of the history of science might force us to see the human dimension of science and scientific research.

Attempts to get secondary teachers to pilot the Science, Ethics and Education Project (SEEP) booklet in a small number of Caribbean schools, has been met with the plaintive cry that time does not permit anyone to look at case studies designed to develop students' sensitivity to the ethics of science, without detriment to the syllabus. There must be a review of such limited views of what science we must teach and how it should be taught.

Let me hasten to add that there are many teachers, innovative teachers, who already include aspects of ethics in their science classroom despite the awful terror that the syllabus apparently holds over our heads. Let me also say that I find some teachers most receptive to the 'new' ideas, but these are the ones who are always in the search for other ways of doing things. The only unfortunate outcome of their ever-present desire for change (as far as science teaching is concerned) is that the lack of challenge is driving them out of the subject areas.

WHAT IS ETHICS? ETHICS IN SCIENCE AND BIOLOGICAL EDUCATION

In the last few years ethical considerations have surfaced in looking at every sphere of human activity. We hear of ethics in law, ethics in medicine, ethics in education, ethic in higher education, even ethics in politics. Many are the calls from society at large for our every action to be guided by ethical considerations.

Syrett and Rudner (1996) in looking at ethics for authors in the education field, suggest that such topics as criteria for authorship, acknowledgements, redundant publication, competing manuscripts, and conflict of interest have not been included as part of ethical standards for authors.

Hamner (1992) brings the debate squarely in the realm of science when he acknowledges that 'discussions of misconduct in science have become prevalent in the literature. He posits that:

> *'The ease by which information is exchanged today has allowed for the general public to become increasingly aware of supposedly "isolated instances" of misconduct in science.' (p.1).*

The American Association for the Advancement of Science (AAAS) offers the following definition of professional ethics:

> *'Professional ethics refers to those principles that are intended to define the rights and responsibilities of scientists in their relationship with each other parties including employers, research subjects, clients, students, etc.' (Quoted by Hamner).*

Hamner (op cit) cites the Webster dictionary's definition of ethics and moral to make his case for a professional code of ethics for scientists.

Ethics

> *'(i) ... the discipline dealing with what is good and bad and with moral duty and obligation; (2a) a set of moral principles and values; (b) a theory or system of moral values; (c) the principles of conduct governing an individual or a group.'*

Moral

> *'1 (a) of or relating to principles of right and wrong behaviour; ETHICAL (b) expressing or teaching a conception of right behaviour; (c) conforming to a standard of right behaviour ... (2) pl ... (a) moral practices or teaching modes of conduct.'*

Kelly (1996) writing in Fullick and Ratcliffe (1996) defines science and ethics thus:

Science

> *'The process of natural enquiry which seeks to propose explanations for observations of natural phenomena.'*

Ethics

> *'The process of rational enquiry by which we decide on issues of right (good) and wrong (bad) as applied to people and their actions.'*

The authors of the document argue that concern between science and ethics is not a new occurrence, but that the magnitude and complexity of today's issues in both science and technology have immense social and personal implications. Some of these issues include 'global change, human genome research, reproductive technologies and nuclear technologies'. They suggest that the position is like this:

> *'The answers lie in science – to determine what we can do. Technology, economies and socio-cultural issues will, also, need to be considered, but as crucial, is a consideration of ethics – to aid us in determining what we ought to do.' (p. 7).*

The authors also deplore the fact that there is *'sufficient recognition of the nature and rigour of ethical enquiry and the ethical dimensions of science itself'*. They, however, admit that Bioethics is the only field in which there is an exception.

Abeleva and Abeleva (1985) cited in Frazer and Kornhauser (1985) see ethics as *'the cement of science'*. They make the case that science is, unlike other activities, very difficult *'to organize and manage ... The main features of this organization cannot be defined*

unambiguously, with rules and formalizations. They largely depend on the conscience of scientists themselves.' (p.43).

In the area of bioethics the Commission for Biological Education (CBE) has been very active. Meyer (1990) rationalizes the need for Bioethics Education by emphasizing four main reasons:

1. *'the scientific community now recognizes that science is not the objective, value-free enterprise that it was once considered to be. It is now seen to be the product of humankind and to be socially determined ... This involves making value judgements and value judgements are influenced by ethical considerations.' (p.10)*

2. *'The community as a whole is more aware of the work of scientists and is questioning the role of science in society.' (p.10).*

3. *'recent advances in scientific knowledge, especially in biology, have faced the community with significant choices which involve value judgements and thus have ethical overtones.' (p.10).*

4. *'as the world becomes more and more overpopulated problems of the inequitable distribution of resources; increased pollution ... and general environmental damage become more acute.' (p.10).*

But it is necessary to clearly define what Bioethics really is. Kuhse and Singer (1990) in Meyer (Ed) (1990) define bioethics thus:

> *'Bioethics is a philosophical enterprise, i.e, it is concerned with the critical evaluation of assumptions and arguments; it is an analytical and critical activity in which the concepts, assumptions, beliefs, attitudes, reasons and arguments underlying decision-making are examined for their validity and consistency…'*

These authors use the debate over the moral status of the early human embryo to illustrate how bioethics works.

On the question of whether Bioethics can be taught Kuhse and Singer argue that many persons suggest that it cannot. These proponents view ethical or moral views as being individualistic and a personal matter. The authors also argue another prevailing view. This latter suggests that since we can argue about right and wrong, ethical considerations are *'not simply a matter of personal preference or choice, nor something to be settled by the judgment of a religious or secular authority. Rather the possibility of argument about ethical issues means that reason has an important role to play in ethics.' (p.64).*

Kuhse and Singer ultimately put forward this solution to the apparent dilemma:

'In short, then, we believe that teaching of bioethics is both possible and necessary, and where possible bioethics should be taught by those with formal training in ethics, although always in close cooperation with those working "at the coalface …" There is a need, therefore to encourage teacher training institutions to regard philosophy in general, and ethics in particular, as an appropriate subject for study.' (p.65).

EHICS AND CITIZENSHIP
Making the Connection

The Institute for Global Ethics UK Trust has developed a fascinating curriculum on the topic *'Ethics and Citizenship: Tools for Moral Decision – Making.'*

One of the main purposes, as outlined in the Introduction, is stated as *'develops pupils' ability to understand about moral and ethical values, and put them into practice; and provides opportunities to reflect on issues, and to take part in discussions.'*

This programme forms part of the National Curriculum in the United Kingdom and has been built on three strands:

> *'political literacy, community involvement, and social and moral responsibility.' (p.1)*

Although the programme covers all three strands it *'focuses on social and moral responsibility'.*

The Ethics and Citizenship programme is designed to impact on Key Stages 3 and 4. It encourages young people to apply specific decision-making skills through:

- **Raising Their Awareness To Ethical Issues**
    - Providing practical experience in negotiating a set of ethical values.
    - Suggesting logical steps that develop moral reasoning skills.
    - Defining moral courage and showing how it plays a part in day-to-day decision-making.

Intended Learning Outcomes and Goals.

The Introduction to the programme lists the following Intended Learning Outcomes and Goals.

The student should be able to:

- Understand and use ethics terminology in a clear and consistent manner, and discuss social and moral issues;

- Negotiate a set of ethical values that reflects a group's common moral ground;
- Develop an understanding of the difference between right and wrong and of the concept of right-versus-right moral dilemmas;
- Analyse right-versus-right moral dilemmas, and develop an ability to resolve them using a variety of decision-making principles;
- Define moral courage and identify how moral courage plays a part in decision-making;
- Understand the changing role of ethics in a technologically-driven world and be aware that sound ethics are essential for survival in the 21st century.

It also lists the types of development, and the key skills that the programme promotes:

- **Spiritual developmen**t, through fostering pupils' awareness and understanding of meaning and purpose in life and differing values in human society;
- **Moral development**, through helping pupils develop a critical appreciation of issues of right and wrong, justice, fairness, rights and obligations in society;
- **Social development**, through helping pupils acquire the understanding and skills needed to become responsible and effective members of society;
- **Cultural development**, through helping pupils understand the nature and role of the different groups to which they belong, and promoting respect for diversity and difference.

Key Skills

- **Communication**, through researching, discussing and sharing information and ideas about a wide variety of social, political and community issues;
- **IT**, through using and applying ICT to analyse issues, events and problems;
- **Working with others**, through sharing ideas, formulating policies and taking responsible action in communities;
- **Improving own learning and performance**, through reflecting on their own ideas and achievements, and setting targets for future involvement and improvement;
- **Problem solving**, through becoming involved in political and community issues.

Life Skills

- **Thinking skills**, through helping pupils to engage in social issues that require the use of reasoning, understanding and action through enquiry and evalualtion;

- **Working related learning**, through helping pupils to appreciated the link between learning and work for a thriving economy and society;

- **Education for sustainable development**, through developing pupils' skills in, and commitment to, effective participation in the democratic and other decision-making processes that affect the quality, structure and health of environments and society and exploring values that determine people's actions within society, the economy and the environment.

And finally, it suggests articulation with other curriculum subjects, including science and geography, outlining very clearly the likely benefits to students at Key Stage 3:

Benefits for Key Stage 3 Students

- Students develop a habit of critical reflection on their experiences, enabling them to learn more throughout life;

- Students become more curious and motivated to learn;

- Students are able to perform better service within their school and community;

- Students strengthen their ethic of social and civic response

- Students feel more committed to addressing the underlying problems behind social issues;

- Students understand problems in a more complex way and can imagine alternative solutions;

- Students demonstrate more sensitivity to how decisions are made and how institutional decisions affect people's lives;

- Students learn to respect the cultural differences of others ;

- Students learn how to work more collaboratively with other people on real problems;

- Students realize that they can make a difference to their own and other people's lives, in their communities and in the wider world.

WHAT STRRATEGIES SHOULD WE USE IN INITIATING AND DEVELOPING ETHICAL ASPECTS IN BIOLOGICAL EDUCATION?

As already outlined the teaching of biology at all levels of the educational system in the Caribbean is teacher-driven, lecture-type, and very heavily focused on content. Little time is spent on teaching for skills and attitudes. To initiate the teaching of ethical aspects complicates the matter even further. It is very important then that great care be taken in the initiation and development of the ideas and methods, if they are to stand any chance of successful implementation.

Although this paper focuses on the innovation process in schools, we should not fail to target other sections of society e.g. parents, service clubs and society at large. There is much wisdom in getting these 'gatekeepers' on board.

It has been said elsewhere that Caribbean people are not usually very adept at cause and effect reasoning. They tend to reserve magical explanations for anything which slightly deviates from the norm. As such then, they view science and scientists as being in the realm of the magical, and are loathe to question them. Great care must be taken therefore, that the society does not interpret the notion of ethics in science as being interfering in aspects that are reserved for a few. How can we ask such persons to be responsible for their activities? How can we question the motive and ethics of scientists who dwell in such hallowed domains?

The main strategy of initiation I would suggest for these gatekeepers should be broad-based education programmes, aimed at highlighting the pros and cons of controversial environmental issues in the society. For example, the government proposes to build a marina on one of the most pristine beaches in the country. Surely some would say it will bring jobs and money. That will most likely be the government's position. But surely the financial side is only one part of the equation. This is where we should begin to get the society into the habit of considering if we should do all that is possible, or even profitable, without examining the consequences of our actions.

The various channels of communication available to Caribbean countries should be employed e.g. television, radio, newspapers, internet, and forms of face to face contact. The message must be at the level of the intended audience, it must be well paced – not too often to be overwhelming or to infrequent to be just another of those matters that one can easily ignore.

The development team should be chosen from the wide cross-section of the education system. The developers should be persons who, having been involved in the development, will serve as effective change agents and opinion leaders. Biological knowledge is necessary for such persons, but equally important will be their values and attitudes, and of course, their skills as communicators. They must be persons who by precept and example can encourage others to follow.

TEACHING ETHICS IN BIOLOGICAL EDUCATION:
Some Suggested Methodologies

It seems to me that the days of positivistic views of science are long over. As a result we as teachers need to approach teaching and learning of science with the ever-constant reminder that science undergoes change mainly due to research, but sometimes through refutations and revolutions. We cannot continue to give the impression that all scientific knowledge is immutable, and furthermore we must not be critical and questioning. Clearly the question of ethics, and more precisely whose ethics, must enter into the evaluation as we attempt to impart the various concepts and principles of science.

Trowbridge and Bybee (1990) use Kohlberg's development of Piaget's research on moral development of children to provide a good introduction of ethical development. Kohlberg's research, used a longitudinal study of boys at ages ten and sixteen following them past the ages of twenty four and thirty. He substantiates the moral development is hierarchical, and may be divided into three levels:

- preconventional, or premoral
- conventional, or conforming
- post-conventional

Preconventional Level

At this level the child is responsive to rules and labels as good and bad, right and wrong, using purely physical terms e.g. *'If he is bad, he is punished: if he is good, he is rewarded. He also interprets labels in terms of the physical power of those who enunciate them.'* (p.93).

Conventional Level

Here the individual's family, peer group, or nation are perceived as valuable in their own right. The attitude is one of conformity to the social order, to the point of loyalty to it. Furthermore the individual actively maintains, supports and justifies the social order.

Postconventional Level

Here the individual makes a clear effort *'to teach to others a personal definition of moral values – to define principles that have validity and applications apart from the authority of groups or persons and apart from the individual's own identification with these groups.'* (p.94)

Kohlberg suggests that there are six stages which coincide with three levels as shown in Table 1.

Table 1

Kohlberg's levels of moral development

	Stages		Motivation
Pre-conventional	Stage One	Avoiding Punishment	Ethnical decisions are made to avoid punishment. Self-gratification is important. Mortality occurs mainly because of fear of punishment
	Stage Two	Seeking Reward	Desire for personal reward and benefit. What is in it for me? What are the consequences?
Conventional	Stage Three	Social Approval	Anticipation of social disapproval or self-guilt. Has stereotypes of good and bad people.
	Stage Four	Law and Order	Anticipation of dishonor. Afraid of losing face or gaining dishonor. Follows social rules. Believes in rule maintaining. Exceptions cannot be made because everyone would start disobeying rules.
Post-Conventional	Stage Five	Social Contract	Concern about self-respect or being irrational and inconsistent. Right actions are constitutional and democratically derived. Free agreement and contract binding between individuals. The way the American government operates.
	Stage Six	Universal Ethics	Concern about condemnation, about violating person's principles, and about maintaining principles as a way of life. Sacredness of life: compassion for fellow humans, universal principle of justice.

Trowbridge and Bybee (1996) expand considerably on their previous ideas, by first examining the topic of controversy in the classroom. They suggest that controversy either crops up unexpectedly or may be anticipated weeks in advance. Teachers then need to develop skills to guide the discussion, emphasizing the need for students to *'deal with opinions of persons whose views differ from their own'*. One good example of a controversy, they suggest, is the issue of genetic engineering, and this may be handled using a debate format.

These authors believe that most of the issues that create controversial situations are of an ethical nature. *'This creates the need to consider the development and maturity of students with respect to their innate abilities to deal with complex ethical problems.' (p.241).* They provide clues for handling these as follows:

- Identify the conflict and theme for the dilemma (e.g. life, liberty, justice, truth, etc.)
- Introduce the scientific or technological problem.
- Clarify the conflict.
- Be sure there is a dilemma (i.e. a choice between two equally unfavorable alternative). Should the person be maintained on life-support systems or be allowed to die? Should justice be done for the individual or the group, concerning air quality that affects everyone?
- Describe the situation and dilemma to the student in understandable terms.
- Delineate the decision made by the main characters in the dilemma.
- Review the moral dilemma and describe what you perceive to the pro/con positions for each stage.
- Ask for a definitive decision with reference to the dilemma (e.g., what should Mary do-stand up for her rights or allow the person to die?)
- Remember that a food dilemma is simple, straightforward, and relevant to students.
- Ask for a justification for the response.

After introducing the dilemma, the science teacher should guide the discussion, making sure the students stay on the topic. The teacher can point out inconsistencies in reasoning and more adequate resolutions to the dilemma. Be sure to let the student answer the dilemma and justify their positions.

Besides designing ethical dilemmas for the classroom, the authors suggest other strategies such as role playing, the learning cycle, morphological analysis, instructional games, small-large group discussions, pictorial riddles, and creativity-synectics.

Role playing is useful in that it allows students to put themselves in other people's shoes. Here you may make the discussion as elaborate as you like. Each student might represent a particular stakeholder and an impartial chairman may be appointed. The strategy allows for the generation of high interest. However, precise, detailed planning is a necessary precursor for success.

Morphological analysis has potential as a method for exploring and explicating solutions for problems arising in controversial situations. This is a creative problem-solving strategy that helps to identify and relate various independent variable or factors. The approach involves several steps:

- A problem is stated in as general terms as possible.
- Students are invited to identify as many independent variables as possible.
- Students state these variables or factors in as many ways as possible.
- Each of the factors becomes an axis on a grid of a two-dimensional or three dimensional model.
- Students then combine the axes or locate intersections within the grid that provide multiple ways of viewing and resolving the problem. To illustrate: suppose the issue was how to rationalize the problem of replacing all of the vehicles dependent on burning fossil fuels in the United States with vehicles that use some other nonpolluting source of energy, such as electricity, solar power, or wind power.

The first step would be to have the class identify independent variables associated with each form of energy (presently in use or proposed). Two axes of a grid might be type of energy versus efficacy of use in a national transportation system. In the first category might be listed fossil fuels, solar energy, nuclear energy, wind energy, water power for electricity, or others. The second axis might contain cost per mile, average highway speed, maintenance of vehicles, convenience of use, conversion cost, and other factors.

	Type of Energy						
Efficacy of use	**Fossil**	**Solar**	**Nuclear**	**Water**	**Power**	**Wind**	**Power**
	Cost	/	/	/	/	/	/
	Speed	/	/	/	/	/	/
	Upkeep	/	/	/	/	/	/
	Convenience	/	/	/	/	/	/
	Conversion	/	/	/	/	/	/
	Other	/	/	/	/	/	/

Trowbridge and Bybee (1996) p. 243.

One of the more unusual strategies that may be used in dealing with ethical/controversial problems is creativity-synectics.

Trowbridge and Bybee (1996) explain this strategy thus:

> *Synectics centers around students being invited to form three types of metaphors to gain different perceptions of a problem. These are used to break mental structural fixedness or psychological set in looking at a problem, thereby contributing to the stimulation of creative thought. The three metaphors are: direct analogy, personal analogy, and compressed conflict.*

In direct analogy, students are asked to compare and contrast two objects or concepts and state how they are similar or different. For example, in a controversy about cutting down the rain forest, they might be asked to compare and contrast birds with airplanes, or tropical woods with corn, or pharmacists with medicine men.

In personal analogies, students might be asked to state how they would feel if they were an endangered species of animal. They might be encouraged to identify with an object or concept such as a river or an evaporating water molecule. They might express their feelings about their potential future or fate in the rain forest.

The two steps above can then lead to a situation of compressed conflict. Students are asked to identify contradictions in the analogies. Work to bring the contradictions closer together by making certain concessions or accommodations.

Frazer (1985) posits that before we can look at methodology of teaching ethics in science, there are two essentials that must be borne in mind.

> *'The first is that the teacher should be well informed about the science and facts related to a controversial topic. The second is that students should be made aware that quality of information they will be using may be variable.' (p.141)*

With those provisos he suggests some methods and critically evaluated each. He quickly rules out the didactic approach to teaching controversial issues since 'we do not learn to make judgements by listening to someone talk.' He, however, sees potential in debates and discussions, provided students are made to think about the issue, and express themselves in the debate or discussion. He also sees virtue in role-playing, simulations, games and case studies.

In looking at debates and discussions he outlines some of the things which are essential. The most pivotal prerequisite is that 'the teacher must be able to provide as much objective information about the issue as the students require.' In these methodologies he suggests the following sequence:

1. Teacher introduce the issue, presenting information on both sides of the argument.

2. Allow an 'open' debate with students freely expressing their ideas, or force them to take sides. Brainstorming is also effective.

3. The teacher as chairperson must be neutral.

4. The size of the groups is important – they should not be too large so as to facilitate individual interventions.

Frazer concludes that community service is also an effective strategy because:

'The ultimate goal of moral education is that students should put their opinions and beliefs into action.'

Agne (1994) quotes Katz and Goodwin (1976) as proposing an active, inquiry learning style. The authors argue that the following skills are generic in dealing with aspects of ethics.

- Thinking and Problem Solving
- Communication
- Self-Sufficiency
- Valuing
- Community Involvement
- Social Action.

These six clusters of skills are elaborated on in Appendix 1.

Fullick and Ratcliffe (Eds.) (1996) see *'the central aim in the teaching process must be to provide the opportunity for a thoughtful, rigorous approach to enquiry.'* Building on this template they suggest that opportunities for ethical considerations should have three characteristics:

1. The issue involved in the 'case study must be clearly defined, providing enough information for students to make judgements about.

2. There should be a framework for dealing with issues involving interpretation, analysis and argument, and critique and decision-making. These facets are elaborated as follows:

    - Interpretation involves:

        - *distinguishing between scientific understanding (what we know we can do) and ethical judgements (what we believe we should do);*

        - *'identifying the different ideas on the nature of ethics and morality which people hold and their influence on ethical analysis' (p.10).*

    - Analysis and argument is concerned with making sure that:

        - *'conclusions are drawn from carefully formulated premises' (p.10).*

        - *students are aware of the type of truth in a statement.' (p.10).*

        - *'correlative relations are distinguished from causal relations.' (p.10)*

        - *'students are aware of common fallacies,' and their origins, especially leading to 'loose and over-emotional discussion.'*

- Critique and Decision-making involves going through a critical review procedure, including:
    - *'reviewing previous analysis and argument for logic and consistency' (p.11)*
    - *giving possible alternative judgements*
    - *'arguing priorities that determine choice of alternatives*
    - *'deciding on 'final' judgement, giving reasons for the choice*
    - *The ultimate aim of ethical analysis is to arrive at a point of view that is acceptable to the issues being considered. (p.11)*

3. *'Any use of ethical analysis should make use of ethical concepts relevant to the issues being considered.' (p.11)*

   Having outlined the principles on which ethical analysis should proceed, Fullick and Ratcliffe provide learning strategies that relate to the principles. The strategies are:

   A. Consequence mapping
   B. Structured decision-making: cost/benefit analysis
   C. Structured analysis of people's action using a 'Goals, Rights and Duties model.
   D. Focused questions.

One (or more) of these strategies is used in the case studies developed by the authors. One example of a case study with biological implications, is given on pages 71-80 in the book produced by the Science, Ethics and Education entitled *'Teaching Ethical Aspects of Science.'* (1996)

A. Consequence Mapping

These are used to encourage students to consider a range of possible implications that arise out of an issue. *'It represents stages in interpretation and starts analysis and argument.'*

The consequence map allows students through brainstorming to look at the broadest possible range of consequence mapping strategy.

Figure 1 illustrates the consequence mapping strategy.

Figure 2 shows a consequence map for use of aluminum containers.

B. Decision-Making Framework

Fullick and Ratcliffe combine aspects of normative and descriptive decision-making models, to produce a six-step framework:

> ***Options****:* List or identify the possible alternative courses of action in considering the issue.
>
> ***Criteria:*** Develop or identify suitable criteria for comparing these alternative courses of action.
>
> ***Information***: Clarify the information known about possible alternatives, with particular reference to the criteria identified.
>
> ***Survey:*** Evaluate the advantages and disadvantages of each alternative against the criteria identified.
>
> ***Choice:*** Make a considered, informed response to the issue, based on the analysis undertaken.
>
> ***Review:*** Evaluate the decision-making process undertaken, identifying any possible improvements. (p.25)
>
> - Steps 1-3 represent interpretation.
> - Step 4 represents analysis and argument.
> - Steps 5 & 6 represent critique and decision-making.

The authors also mention another framework RESOLVEDD as put forward, by Pfeiffer (1992), which is very useful in personal ethical conflicts. The framework goes as follows:

> R - Review the history, background and details of the situation.
> E - Estimation of the conflict or problem one confronts.
> S - Solutions possible in the situation are listed, grouped and reduced to a small number of main solutions.
> O - Outcomes or consequences of each main solution are described.
> L - Likely impact of main solution on people's lives is noted.
> V - Values upheld and compromised by main solutions are examined.
> E - Evaluating and refining of main solutions and searching for other solutions in light of relevant value conflicts.
> D - Decision one arrives at is clarified, refined, supported.
> D - Defence of the decision against objections to major weaknesses. (p.28)

C. "Goals, Rights and Duties" Framework

Fullick and Ratcliffe (Eds.) use the work of philosopher Gerald Dworkin to propose this strategy. The strategy helps science students to wrestle with courses of actions which are equally attractive, acceptable and seemingly justifiable.

> ***Goals*** - one way of judging an action is to ask what it intends to accomplish – that is, its goal.
>
> ***Rights*** - someone has a certain right if that *someone 'is entitled to a certain kind of treatment no matter what the consequences.'* (p.29)
>
> ***Duties*** - *'A duty is an obligation to act or behave in a certain way, and may have its origin in a corresponding goal or right.'*

'Dworkin suggests that ethical dilemmas can be analyzed by determining the goals, rights and duties of the parties involved, and seeing how analysis of the conflict between these may help to find possible solutions.'

D. Focused Questions

In many cases we as science/biology teachers introduce new ideas and thinking to students by using written materials, audiotapes or even videotapes/DVDs. These real documents are used to elicit thoughts and ideas from students. Difficulty of interpretation should stretch them to work even harder at effectively decoding the message, but teacher support is crucial.

'Providing students with the opportunity to think through their own ideas and to develop their own solutions to ethical dilemmas is thus dependent on several kinds of understanding:

- *understanding the nature of the problem (interpretation)*
- *understanding the solutions which may be offered to that problem (analysis and argument)*
- *understanding why one solution may be preferred over others, and why the preferred solution may differ from person to person (critique and decision-making).*
- *understanding the basis of their own preference (critique and decision-making).*

CHOOSING CONTENT FOR ETHICAL CONSIDERATION IN BIOLOGICAL EDUCATION IN THE CARIBBEAN

Most areas of the world are beset by persistent biological problems which clearly require ethical considerations. The Caribbean is no different. However, there are differences on the scope and level in Caribbean life compared to other countries. We really differ in the gravity of the problem and success in solving them, more than anything else. Nevertheless Caribbean

peoples must learn how to handle these ethical questions even if the situation is not acute as yet.

At the primary level we should infuse ethical considerations into a variety of biological areas, such as:

- Ourselves – who is a Caribbean man?
- Food – use, abuse, preservation.
- Population growth
- Conservation – including land and marine resources
- Man's effects on the environment – progress or destruction?
- Drugs – use and abuse.

At the secondary and tertiary levels, along with the topics listed above, we need to add:

- Abortion
- Genetic Engineering
- Cloning
- Depletion of renewable and non-renewable resources
- Tourism – its effects on the environment.
- Population explosion
- Using animals in experimentation
- HIV-AIDS
- How should the law apply to tobacco and marijuana?
- The progress/destruction dilemma
- Soil erosion
- Solid waste disposal
- Over-fishing
- 'Genetic diseases – should some people have offspring?
- The effects of natural disasters on the environment
- Chronic diseases e.g. diabetes.

This list of possible topics is not exhaustive.

To illustrate the idea of the procedure to be used in ethical matters the Teachers' Notes on *'How Should the Law Apply to Tobacco and Marijuana?'* is included in Appendix 2.

ASSESSMENT OF ETHICAL OUTCOMES IN BIOLOGICAL EDUFATION

Since assessment of ethics deals with values and attitudes, the use of traditional pencil and paper tests is not highly recommended.

The Science, Ethics and Education Project argues that although teachers 'use the activities in the case studies for assessing students' abilities in analysis … it is important that it is not the opinion or decision that is evaluated, but the quality of the analysis' (p.32).

The authors of the SEEP report (Fullick and Ratcliffe, eds.) also suggest that the decision-making framework could be used for students' analytical abilities. The options – criteria – information – survey – choice – review framework may be used by students to layout their written work produced during discussion. This written work, it is opined, could provide evidence, of how effective students have been in listing important options, and how clearly criteria have been identified.

Students may also be assessed by closely examining 'the survey section of the written work'. The Project recommends the following ideas that:

- appropriate information has been drawn - credit can be given for each piece of information used;
- advantages and disadvantages have been considered, using the factors identified;
- a good number of advantages and disadvantages have been presented.

Very important it is to assess the students ability to present rational arguments based on their own analysis. However, all the learning/teaching strategies outlined in this paper may themselves be used as assessment procedures to ascertain abilities to argue, think critically, and articulate a reasoned position. The ability to analyze is critical in the determination of whether students have assimilated ethical notions in relation to biological knowledge.

Perhaps the ultimate assessment is to recognize how such ethical considerations have influenced life styles and future behaviour.

DIFFUSING AND IMPLEMENTING ASPECTS OF ETHICS IN BIOLOGICAL EDUCATION FOR CARIBBEAN SCHOOLS

So far this paper has looked at some of the strategies proposed for initiation and development of aspects of ethics in biological education for Caribbean schools. All this is fine in itself. However, one must include in any such treatment of innovation the strategies of diffusion and implementation which will ensure that these materials developed are properly disseminated and effectively use in classrooms. Clearly, if these factors are not taken care of with wisdom and care then the whole development might prove to be nothing but wasted effort.

In the Caribbean region, because most curriculum innovations are centrally controlled, and even moreso because there are not the choice of innovations as obtain in more developed countries, diffusion tends to be haphazard and matter-of-fact. Very little attempt is made to set up links of communication between change agent and the user system.

King (1999) puts the matter this way:

'As a result of this lack of communication there is a state of unreadiness, ignorance and unwillingness in schools to implement the innovation of course, the lack of teacher preparation features high in the list of barriers to successful implementation. If ... well-meaning innovations are to be enjoy a fair measure of adoption and implementation in Caribbean school, every effort must be made to devise the ways and means of effectively communicating knowledge and skills about the innovation to the system at large.' (p28).

Added to the obvious constraints that even run-of- the mill change and innovations face, is the fact that this accent on ethical aspects is so sensitive and controversial. This makes the task even more challenging.

I would like to suggest, using Miller and Seller's (1990) ideas, that we focus on four factors in the search for effective strategies for implementing this innovation:

A. Characteristics of the Innovation.
B. Characteristics at the School System Level.
C. Characteristics at the School Level
D. Factors External to the School.

Characteristics of the Innovation

Teachers and the system must be convinced that there is a need for the innovation. To most of us this is clearly enough, but many biology teachers will find it time consuming and extra work. They must be 'sold' on the benefits of the new ideas and skills, and these have to be made available through constant and meaningful exposures to teacher reorientation.

In this empowering activities we must insist on clear, simple inputs, accentuating the quality of the materials, and making sure that they are easily available. If any of these is in the slightest way efficient, then the task becomes more onerous.

Characteristics of the School System Level

Caribbean education systems tend to be very conservative. Change is resisted, even abhorred. Attempts to implement ethical aspects in biological education must cut through the veil of fear, apprehension and provide confidence that change can be beneficial.

Principals and teachers and education officials will need to be trained/re-trained to understand and use the innovation. Such activities should be part of an overall plan of professional development at all levels.

The change agents must always bear in mind the challenge of overload – too many changes, too soon could lead to lethargy and burn out. We need to be realistic about what is possible with reasonable time lines. Over-enthusiasm and evangelist fervour of change agents sometimes impose unacceptable targets.

Characteristics at the School Level

Principal/teacher and teacher/teacher relations are also important factors in innovation implementation. This is even more acute when the innovation is so controversial. We need therefore, to be aware of the structures and relationships that exist in schools, always remembering that as an institution a school is not simple. Indeed it is quite complex.

Factors External to the School System

These include the various Ministries of Education, parents, service clubs, and all who can blunt any attempt at change. To leave them out of the loop is to court disaster.

We need to involve them as early as possible, cognizant of their own strengths and limitations in matters of ethical, biological education, and the challenges of change and innovation.

Proper and sensitive preparation could make them our most valuable allies.

SUMMARY

BIBLIOGRAPHY

Bauer, H. H. (1995). Ethics in Science. Virginia Polytechnic Institute and State University, Blacksburg, VA.

Frazer, M. J. and Kornhauser, A. (Eds.) (1985). Ethics and Social Responsibility in Science Education. Pergamon Press.

Fullick, P., and Ratcliffe, M. (1996). Teaching Ethical Aspects of Science. Southampton, England: The Bassett Press..

Hamner, Vincent, N. (1992). Misconduct in Science: Do Scientists need a code of Ethics? [On-Line] ERIC Digest.

Institute for Global Ethics (2003) [On-Line].

Johnson, K. (1996). Scientific Literacy: Does it Affect Teachers' Attitude to and Practice in Science Teaching? Unpublished B.Ed. Thesis. University of the West Indies, Barbados.

Jones, F. (1990). The Construction and Validation of an Instrument to Measure Scientific Literacy in Fifth Form Students in Rural Secondary Schools in St. Vincent and the Grenadines. Unpublished B.Ed. Thesis. University of the Wet Indies, Barbados.

King, W. K. (1982). Aims and Practice in Science Education: Some Case Studies in Barbados. Unpublished Doctoral Thesis, University of Southampton, Southampton, England.

King, W. K. (1998). Teaching Ethics in Science Classrooms. Paper presented at Science, Ethics and Education Workshop, UWI, Cave Hill, Barbados.

McWethy, P. J. (1994). Basic Biological Concepts: What Should the World's Children Know? NABT, Virginia.

Meyer, G.R. (Ed.) (1990). Bioethics in Education. IUBS-CBE.

Meyer, G. Rex., (1995). Teaching Secondary Biology for Social Relevance. GRM Educational Consultancy, Sydney.

Syrett, K. L. and Rudner, L.M. (1996). Authorship Ethics (On-Line). ERIC Digest ED410318. ERIC Clearinghouse, Washington, D.C.

Trowbridge, L. and Bybee, R. (1990). On Becoming a Secondary School Teacher. Englewood Cliffs, N.J.: Prentice Hall.

Trowbridge, L. and Bybee, R. (1996). Teaching Secondary School Science. Englewood Cliffs, N.J.: Prentice Hall.

Wilcocx, J. R. and Ebbs, W. L. (1992). The Leadership Compass: Values and Ethics in Higher Education [On-Line] ERIC Digest, ED350970. ERIC Clearinghouse, Washington, D.C

APPENDIX 1

IMPORTANT GENERIC SKILLS (Agne, 1994)

A. Thinking and Problem Solving

Integration of facts and concepts
Formulation of problems and assessment of alternative solutions
Critical analysis of information and arguments including the search for possible bias.

B. Communication

Preparation of written and oral reports that summarize, analyse, and communicate knowledge to others.

C. Self-Sufficiency

Actual growth, selection, and preparation of food Purchase of a week's food on a restricted budget.

D. Valuing

Identification and clarification of values in order to integrate knowledge and ethical beliefs with possible action

Examination of actions that result from one's values.

E. Community involvement

The community is used as a laboratory for learning about advertising, food marketing, the political process, and historical food traditions

Collection of accurate information from the world around them is important and complements research efforts made through books.

F. Social Action

Publication of research results, thereby educating others

Formation of groups to work with existing community groups in order to influence public policy.

Taken from Agne, R.M. (1990) in Frazer, M. and Kornhauser, A. (Eds.) (1990). Ethics and Social Responsibility in Science Education. Pergamon Press.

APPENDIX 2

HOW SHOULD THE LAW APPLY TO TABACCO AND MARIJUANA?

Teachers' Notes

Introduction

One of the major debates in Caribbean societies is that whether marijuana should be legalized or not. The proponents of legalization argue that the substance is not as dangerous as common belief would suggest. They believe that it is not habit forming. Some even argue its legitimization on the basis that it forms part off the worship of certain religious movements.

Recent research on tobacco, on the other hand, seems to suggest that it has harmful effects on the smoker's body, as well as those nearby who are exposed to the side stream of smoke. Clearly, there is a need to examine all these pieces of evidence in a dispassionate manner with a view to coming up with a well-reasoned and thoroughly-research position. The effects of emotion should be minimized, if not eliminated all together.

Nicotine Fact Sheet

There are enormous amounts of data on what nicotine is and its effects. Some data are at best inconclusive, but the majority point to this substance being very damaging to health, both psychological and physiological. The many legal actions against cigarettes in many developed countries is ample evidence.

Here are some of the established facts, which most research confirm.

- Nicotine is the drug in tobacco that causes addiction, and all its attendant disorders.
- When a person smokes a tobacco product they inhale the smoke which contains nicotine as well as over 500 chemicals.
- The smoke from tobacco also contains tar which is damaging to the mouth, throat and lungs.
- Nicotine reaches the human brain within 10 seconds after intake.
- The substance stimulates the brain and the central nervous system.

How Does Nicotine Affect the Human Body?

Immediate Effects

Among other things, it has been shown that smoking, and the nicotine it produces increase blood pressure, heart rate, and rate of respiration; it thickens the blood and narrows arteries; it causes skin temperature to decrease. In some cases it may cause diarrhoea and vomiting.

Long-term Effects

Prolong smoking helps to exacerbate all the short-term effects, leading to very serious chronic diseases. Some of these include: high blood pressure; arterial sclerosis; cancer of the mouth, throat, lungs and upper respiratory tract; bronchitis and/or emphysema; stomach ulcers; reduction in effectiveness of the immune system. It also leads to production of abnormal sperm in males, resulting in impaired reproduction functions.

Nicotine and Pregnancy

Smoking has been shown to incline pregnant women to premature detachment of the placenta, and increased preinatal death rates. But the nicotine causes impairment of the unborn child as well. Research shows tha the substance causes impairment of physical and mental development, Sudden Infant Death Syndrome (SIDS), and the baby, haws a greater likelihood of being hyperactive.

What Happens When You Stop Smoking?

Because nicotine is so addictive, there are serious withdrawal symptoms that may occur when one is not using the drug. Some of these withdrawal symptoms are:

- drop in pulse rate and blood pressure
- sleep disturbance
- tension and restlessness
- depression
- irritability
- constipation
- difficulty in concentration.

Although these symptoms cause some discomfort, the benefits of quitting the smoking far outweigh these. Clearly, improve health is better than all of the various ailments listed above. Every effort should be made to discourage young people from picking up the smoking habit.

Marijuana Fact Sheet

The original research on marijuana indicates that marijuana is injurious to health. Some present day research still points in that direction. However, some more recent research seems to show that the drug has beneficial uses. Indeed, some are arguing that there is no harm in the use of this drug. There is some evidence reported, however, that as marijuana use increases, tolerance level decreases, leading to possible dependence.

Marijuana is obtained from the hemp plant and is smoked in cigarettes or pipes or eaten or boiled in water to produce a beverage. The drug is called different names in different countries e.g. pot, grass, weed, reefer, ace, ganja, boo, broccoli, joint. The plant – scientific

name, Cannabis sativa, belongs to the same family as the Jute. Jute is used for its fibre to produce 'rope' and certain types of containers called 'jute bags'.

Immediate Effects

Some of the immediate effects of marijuana are increased pulse rate; impairment of short-term memory leading to confusion and difficulty to think logically; restlessness, anxiety and excitement; hallucinations and psychotic episodes; impaired coordination, motor ability, driving ability and concentration.

Sometimes perception is altered to the point of hallucinations, as mentioned above.

Long-term Effects

Research reports that, if used over a long period, marijuana may have the following effects, among others:

- Toxic effect on brain nerve cells
- Increased risk of lung cancer
- Risk of chronic bronchitis, and other respiratory diseases
- Slow, confused thinking, memory impairment
- Apathy
- Suppressed effects on sperm
- Impaired immune system
- Blood vessel blockage

There are certain physical discomforts that apparently attack marijuana users. These include diarrhoea, cramps, impaired sex drive, as well as physical dependence on the use of the drug.

What Happens When You Stop Using The Drug?

If marijuana use is abruptly stopped, certain withdrawal symptoms will be experienced. These include nausea, insomnia, irritability and anxiety.

Marijuana and Pregnancy

Research indicates that marijuana use drug pregnancy has been associated with low birth weight, mental and physical characteristics similar to the condition known as foetal alcohol syndrome – facial deformities, heart defects, deformed joints, small head. It may also cause tremors and startle response withdrawal symptoms in newborn children.

Miscellaneous Facts on Marijuana

- The cigarettes contain more of the carcinogen benzopyrene that tobacco cigarettes.

- Psychological addition to marijuana is the strongest dependence.

- Addiction to marijuana can occur over a very short time period.
- Marijuana and aging effect the brain in very similar ways. This places the long-time user in high risk for serious and premature memory disorders.
- Marijuana smoking has been proven to have adverse effects on the female reproduction system.
- The tar in a marijuana cigarette is 50-100% greater than that of tobacco.
- THC, the psychoactive ingredient in marijuana, which is stored in the fact of the body, causes harm to the brain and body by causing the cells to become toxic up to 30 days after the last use.
- Marijuana use has an adverse effect on the social relationships of the user due to serve mood swings and lack of interest.
- The emotional development of adolescent users may be interrupted.
- Marijuana use also cause a motivational syndrome. This means that the user will lose interest in activities and lose drive and motivation.

Advocates For Marijuana Use

There are strong arguments which seem to suggest that marijuana use is no more harmful than tobacco and alcohol. Some persons are lobbying policy makers to legalize the drug because of two main reasons.

- It will decriminalize it and prices will fall, leading to decrease use.
- It is an essential part of the worship of such religious groups, like the Rastafarians.

Cannabis in Medicine

Commissiong (1978) claims that cannabis was listed as an all-purpose drug as early as 2737BC by the Chinese Emperor Shen Nung. He traces its use across India, the Arab world, and eventually to Africa. He suggests that even in the USA in the 1930's marijuana was extensively used as a medicine, and that the cessation of use was somehow tied up with the imposition of the marijuana tax in 1937.. (p.2)

Among the medicinal uses, Commissiong lists for Jamaica are glaucoma, hypertension, anorexia and as an analgesic. The ganja use in Jamaica, he outlines thus:

> *"In Jamaica ganja is an established folk medicine. It is either brewed as a medicinal tea or tonic, or applied externally in various preparations as ointment. The green leaves are also used on open wounds". (p.3).*

He lists, besides medicinal use, four other uses: in religion, in commerce (once the basis of a vast fibre industry – rope, ship sails etc.), as an aid to work, as an intoxicant.

Perhaps the most compelling arguments for the medicinal use of marijuana is made in the following 1998 extract from the internet.

Marijuana As Medicine: Facts The Government Ignores

The DEA (Drug Enforcement Administration) classifies marijuana as a dangerous drug with no medical value. That classification contradicts mounds of evidence showing marijuana to be a very safe and effective medicine. Marijuana is more effective, much less expensive, and much safer than many drugs currently used in its place. Marijuana can provide excellent relief for those who suffer from cancer, AIDS, glaucoma, multiple sclerosis, chronic pain, arthritis, rheumatism, asthma, insomnia, and depression. If knowledge of marijuana's many medicinal uses, its remarkable safety, and hemp's enormous potential as a natural resource become widely known, the DEA fears that support for Marijuana Prohibition will collapse, and thus threaten the DEA's budget. To maintain the myth that marijuana/hemp is useless and dangerous, the DEA prohibits medicinal use of marijuana, denies researchers access to marijuana for use in clinical studies, and rejects all applications to grow industrial hemp. In 1988-after reviewing all evidence brought forth in a lawsuit against the government's prohibition of medical marijuana – the DEA's own administrative law judge (Judge Francis Young) wrote:

> *"The evidence in this record clearly shows that marijuana has been accepted as capable of relieving the distress of great numbers of very ill people, and doing so with safety under medical supervision. It would be unreasonable, arbitrary and capricious for the Drug Enforcement Administration to continue to stand between those sufferers and the benefits of this substance in light of the evidence."* Judge Francis Yong of the Drug Enforcement Administration went on to say:

"Marijuana, in its natural form, is one of the safest therapeutically active substances known. In strict medical terms, marijuana is safer than many foods we commonly consume." Judge Young recommended that the DEA allow marijuana to be prescribed as medicine, but the DEA has refused.

Although the federal government claims marijuana has no appropriate medicinal use, the federal government contradicts itself by supplying government-grown, FDA-approved marijuana cigarettes to 8 seriously ill Americans remaining from its discontinued medical marijuana program. The Federal government closed its medical marijuana program in 1992 after the AIDS epidemic created a flood of new applicants. In November 1996, California voters approved an initiative (Proposition 215) that re-legalizes the personal use and cultivation of marijuana for medicinal purposes.

Fig. 1: A structure for consequence mapping

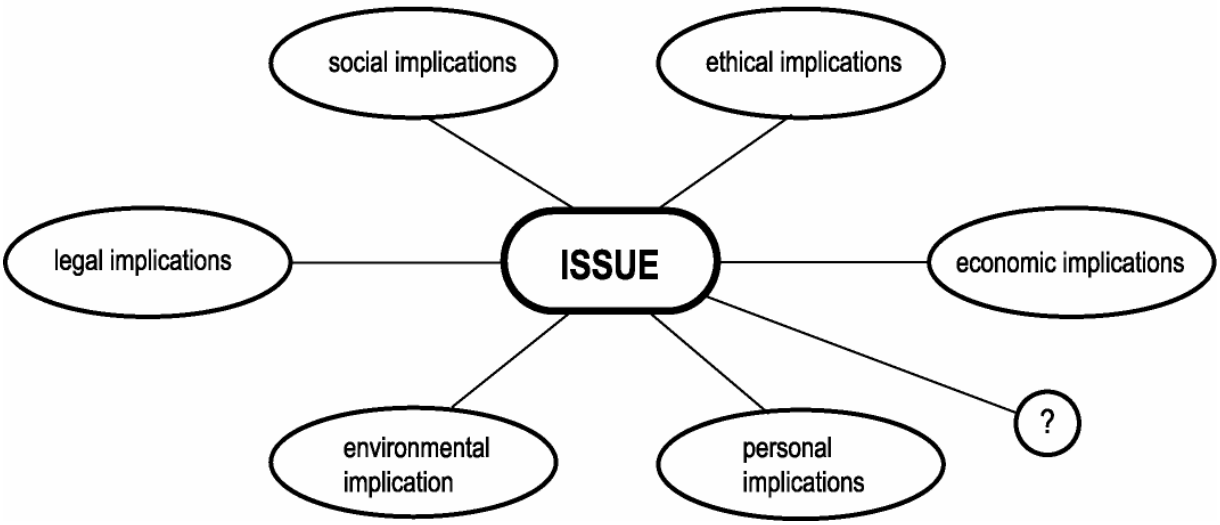
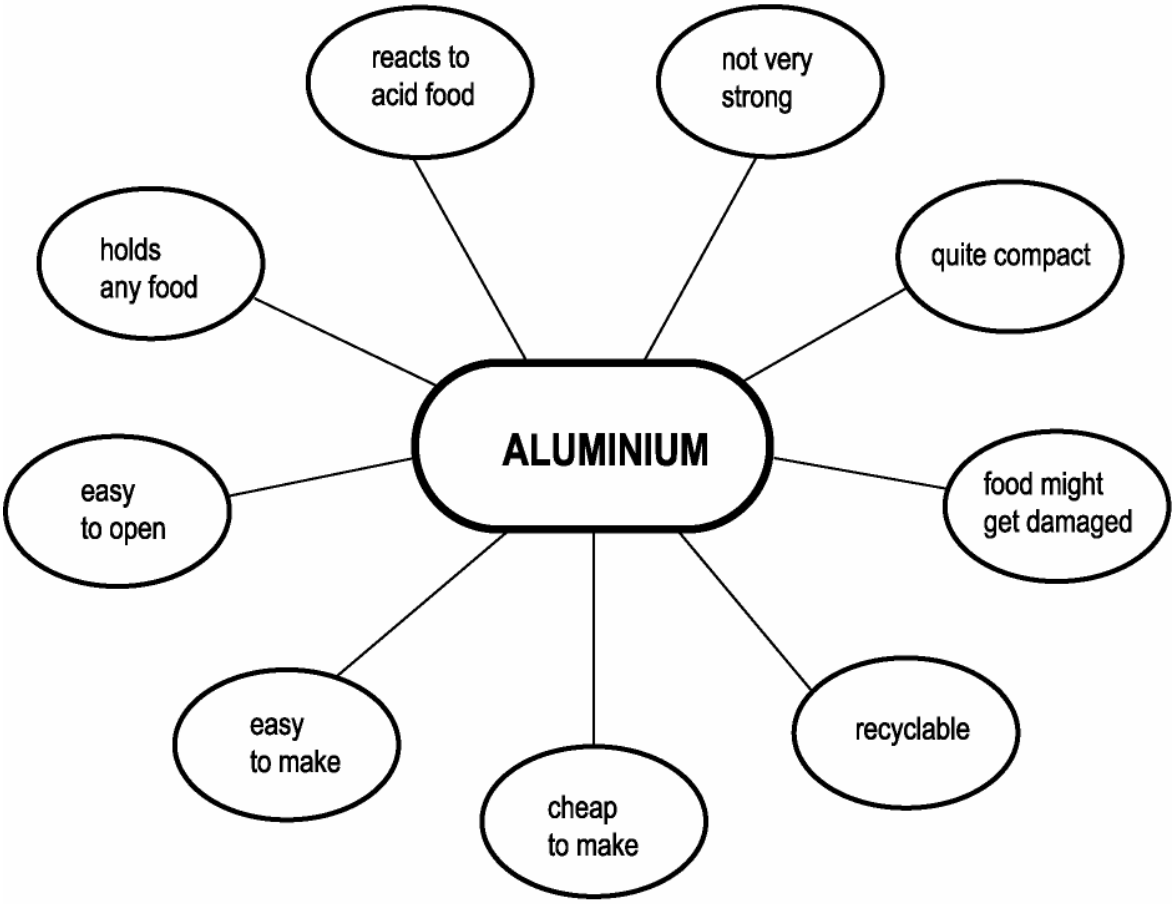


Fig. 2: A consequence map for aluminium containers



Good: 5 Bad: 4