Challenging Learning Across the Generations with Particular Reference to Bioscience Ethics Education:

A draft proposal for the Education Department of the International Network of the UNESCO Chair in Bioethics (Haifa) by Irina Pollard

One of the activities undertaken to disseminate information concerning the Universal Declaration on Bioethics and Human Rights, adopted in 2005 by UNESCO, is the Ethics Education Program. This program maps existing teaching material in the area of ethics in the Member States of UNESCO. Different programs are described, discussed in expert meetings, and made available on the Global Ethics Observatory website http://www.unesco.org/shs/ethics/geobs. Experiences concerning the contents, passion, methods and materials of existing programs are therefore publicly accessible and can be exchanged among experts. Teachers who want to initiate ethics teaching can find suggestions and ideas in the database.

The quality of ethics teaching programs, however, depends substantially on the quality of the teachers. Ethics teaching can be made much more influential and attractive for students if it is presented by a highly qualified, stimulating and inspiring teacher. The present proposal is an all-purpose guide highlighting possible ethical dimensions of science and is divided into two parts—general background and specifics identifying skills where I may possibly be useful in facilitating a flexible series of interconnected workshops and educational tools in bioscience ethics. The specific themes, as identified in Part II, can readily be adapted for team teaching and integrated as required within the overall curriculum of our fledgling UNESCO Education Department. Bioscience ethics facilitates free and accurate information transfer from applied science to applied bioethics. Its major elements are increased understanding of biological systems, responsible use of technology, and curtailment of ethnocentric debates to be more in tune with new scientific insights. Pioneered by me in 1994, bioscience ethics has become an internationally recognized discipline interfacing science and bioethics within professional perspectives such as medicine, law, bioengineering and economics. The fundamental feature of the discipline is its breadth; thus, facilitating streamlining of significant aspects across future learning/teaching requirements while, at the same time, provide individual student/teacher choice of topic or field of endeavour.

Validating science into the teaching and practice of ethics is important because science plays a crucial role in the learning of ethical behaviour. Overlooking such critical aspects of learning must, inevitably, diminish a student’s comprehension of the true natures of science and of ethics. Scientists and the population at large are frequently forced to make difficult value-laden ethical choices which may include choices between pure and often more lucrative applied research projects. Critical choices such as whether to work on military or non-military projects, whether to generate power from depleting energy sources or from renewable energy, by what means should climate change be managed are crucial to our future wellbeing. Increasingly, potential conflict between industrial developments and the

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1 Bioscience Ethics by Irina Pollard. Cambridge UK: Cambridge University Press; 2009.
ecological health needs of the planet force us to select from a variety of possible alternatives – especially since a sizable fraction of current scientific research is funded by big business or the military which, predictably, imposes restricted information access on corporate, security or other grounds. Scientists, because of their specialized training, have distinct social responsibilities to ensure that society is sufficiently knowledgeable to assist their communities make informed choices about the uses and potential abuses of science. The introduction of bioscience-bioethical themes in all education curricula should be a definite requirement since all students will need to participate, as future citizens, in making ethically informed choices about the ‘doing’ of science.

PART I: General Background: Active Approach to Learning and Teaching

The delivery of effective education can be through face-to-face delivery, multimedia, video and online conferencing tools, podcasting lectures and 'online only' courses. When designed effectively, e-Learning has been recognised for its potential to enhance learning and to increase student accessibility to higher education. Online-based teaching programs, at their best, promote flexibility in which students listen to their i-Lectures in private and do their 'homework' in the classroom with their educators and colleagues. Typically, the focus is on the topic's most difficult aspects or on widening the concept through deliberating broader implications – all promoting valuable learning interactions.

Active learning is about learning by doing – it involves a student-focused approach and requires students to do meaningful learning activities and think about what they are doing. Active learning demands that students became co-creators of their learning; that is, teaching and learning activities and the assessment tasks require students to participate in their learning. This challenges the more passive forms of direct instruction since active learning techniques are far-reaching and may well require students to design their own activities and assessments, team learn or use group design. For example, students may choose or modify a task, or set standards for the outcomes of the task, or can mark each other’s work, give feedback, and reflect on the learning that was developed. In essence, group work provides a thought-provoking range of opportunities to engage in a wide variety of skills such as resourcefulness, critical thinking, group interaction and communication, time management, logical and succinct delivery of outcomes, leadership negotiation, conflict management and much more.

The main principle behind active learning is to directly engage and to challenge students in activities that activate both mental and physical skills and to question their own level of understanding.

<table>
<thead>
<tr>
<th>Traditional Teaching</th>
<th>Active Learning</th>
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<tbody>
<tr>
<td>Instructor is a knowledge transmitter.</td>
<td>Instructor is a problem setter and coach.</td>
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<tr>
<td>Students are passive learners.</td>
<td>Students actively formulate their own learning.</td>
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<tr>
<td>Students apply acquired knowledge in tests.</td>
<td>Students develop cognitive learning strategies.</td>
</tr>
<tr>
<td>Learning is content-based, subject focused.</td>
<td>Learning focus is on problem solving.</td>
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Active learning techniques (see below) are designed to harness the power of collective intelligence and network effects.
Active Learning: Example Case Studies

1: Ask your students to choose one slide from a particular PowerPoint lecture presentation which piqued their interest and then expand on the content by providing a couple of extra slides. In this way students are actively engaged in research and acquire practical experience in delivering course materials.

2: Ask your students to write a newsprint article, or produce a video or audio news report, based on published bio-scientific research, or having the students re-write or edit a problematic newspaper article to be more accurate, more ethically balanced. This could include reference to additional media resources that clarify science-based and ethical perspectives or clarify the original data where it is available to the public.

3: Group work is where the group is responsible for delivery of a project outcome or analysis of real-world case studies and dilemmas. Specifics might be to critically appraise the ethics of a science-based article. Students gain experience in active rather than passive reading and the critical evaluation of possible biases, or prejudices, of scientific material as presented to the general public. Another related technique is to directly engage students in the design and execution of original research, in this case both as researchers and subjects. This advanced scheme allows the educators to work alongside the students as peers rather than sitting above them as judges. A good idea is to ask each student to take on a rotating role of Presenter, Manager and Recorder in addition to a Reflector role. Leadership roles are then experienced by all members of a particular group.

   We may well remind ourselves that the word ‘assess’ is derived from the Latin word *assidere* which means ‘to sit beside’ emphasizing that teachers and students sit beside each other as partners with common educational objectives. In this sense, assessment is not simply a testing and judging (ranking) instrument, but also a nurturing and mentoring tool in the learning and teaching processes.

4: Problem-based learning (PBL) is a popular technique in medical schools where rather than presenting content as in traditional classroom teaching, the teacher poses a problem for the students to solve, usually in groups. The main characteristics of PBL are:

   1. Students explore real world, open-ended problems.
   2. Learning is largely self-directed, including planning, implementation and evaluation.
   3. The activities are usually conducted in small groups.
   4. Teachers take the role of facilitators.
   5. Learning outcomes emphasize not only content knowledge but also process and learning attitudes.

5: Discovery-based learning (DBL) is similar in concept to problem-based learning. The main difference is that DBL is structured around practical learning environments such as science labs. Students are required to design and construct their own investigations in order to discover fundamental principles within a particular domain; i.e., putting theory into practice.

6: Concept Maps are instructional rubrics that show students how to make a map with clear routes to their destination – they provide information and direction within the whole picture (see selected example on page 6). Using concept rubrics in education is far beyond routine
learning as it is about engaging students in collaborative, active learning within a framework of social evaluation.

**Part II: Existing Skills and Materials Available to Education Department**

During the last two decades there has been a considerable increase in science information followed by rapid development of new techniques and varied applications. Applying new knowledge raises new challenges – not least the challenge of interpreting the ethical significance of any new scientific application. Despite this, and at a time when student demand for ethics education is increasing, ethics is not currently a significant part of the senior high school or university curriculum. Thus it is clear that a greater focus on science-ethics education is essential. We need to examine in greater detail the ethical questions arising out of simple everyday life events, discuss ethical dilemmas and interrogate and explore new ways of being. It must be emphasized that children begin to develop enduring ethical standards at an early age and that these standards are realized through experiences of early childhood. The junior and senior high school years are crucial transitional years where students are most susceptible to both negative and positive experiences. Consequently, there is a need for targeted educational programs dealing with lifestyle choices, health and wellbeing ratings, sexual experience, fertility and responsible reproduction. Long before young adults consider parenthood a desirable option, they need the opportunity to acquire adaptive biological, technological and ethical knowledge. Contemporary subjects dealing with issues as identified above should be incorporated into the school curriculum at an appropriate time that correlates with the students’ biological age rather than with their chronological age.

There are many reasons for my proposal to review existing high school curricula. For instance, statistics from differing international sources (Australia, Canada and the United Kingdom, among others) have shown that girls reach puberty at a younger age and undergo menarche (first menstruation) years earlier than did girls in the middle of the last Century. This accelerated development is thought to be predominantly due to improvements in nutrition and socio-environmental change while other theories range from rising rates of obesity to endocrine-disrupting chemical ubiquitously present in our environment. The onset of puberty signals, in both sexes, a complex period of development experienced as a changing kaleidoscope of physical, cognitive, emotional and social capacities that climax in sexual maturity and full reproductive potential. Indeed, adolescence ushers in profound changes in patterns of risk taking relating to health. Reports originating from many countries have established that adolescent sexual experience and heightened substance use are significantly interrelated. Notably, high school students are well acquainted with sexuality and have, on

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the whole, had experience with one or more partners before age 17. They also have ready access to tobacco, alcohol and a variety of other recreational substances. Girls, who have gone through puberty early, are twice as likely to have been pregnant or aborted a pregnancy at the age of eighteen, compared with their peers – a serious statistic impacting on the health of the present and subsequent generations. Whether the fall in the age of puberty is based on our evolutionary response to improved health and nutrition or not, we still have an ethical obligation to see that communities focus on preparing young kids for sexual maturity with all its attendant vulnerabilities whenever it might arrive. Educational guidelines for teaching sexuality should promote that all children need to know about puberty before it happens but for a growing number of primary schoolers this is not the case.

In summary, the above demographics highlight the necessity for the introduction of a coordinated course, or series of team taught programs, made available and implemented by UNESCO’s Education Program, aimed at increasing reproductive understanding at a stage when the emotional ability to make serious, informed decisions is not yet fully developed. Across Australian public schools, for instance, education regarding safe sex practices is not taught in the classroom until students reach the senior years and, for early maturing girls, this may not be in time for their first sexual experience. Even lessons on reproductive biology, minus sexuality, are generally not taught until later years, making holistic understanding fragmented and uncoordinated. Conceiving and bringing up a child is the most important responsibility any adult can have and there is much to learn about interacting genetic and epigenetic variables affecting biological systems and behavioural consequences. Learning needs to be in tune with present-day reality and insights.

The present proposal aims to build a secular multifaceted course, or series of programs, informing students and their educators about important physiological changes that go on in young bodies and which may, depending on circumstance, have positive or negative effects across societies and generations. The proposed programs will not follow or impose a particular model or specific view of ethics. Rather they will articulate a series of transdisciplinary topics that reflect and integrate current bioscience-bioethical theories and principles as they relate to human reproduction. The next section identifies topics that I’m familiar with and teach within the axis of bioscience ethics (‘Lecture Descriptions and Links’ provide summary of topics and links). I am happy to assist where my expertise is relevant and look forwards to making operational contributions. Access to additional potential projects can be found in my student text book ‘Bioscience Ethics’ CUP, 2009 or from my education web portal freely accessible at http://www.bioscience-bioethics.org/. However, in order to incorporate effective tools and innovative ideas into the classroom teacher guidance has to be provided to ensure that learning sessions are culturally appropriate. A related issue concerns assistance provided in the translation of workshop subject matters and their realization within individual schools i.e. ethics from workshop to classroom. Importantly, educational realizations need to appropriately respect adaptive local norms and diversity while also protecting secular stewardship and international rights. The UNESCO community is well covered by its stewardship of secular ethics as expressed in its charter.

**Bioscience Ethics Education: Existing Notes and Teaching Materials**
The following tools may be used to initiate faculty undergraduate/postgraduate discussion workshops relating to possible ways of incorporating within their institutions formal bioscience-bioethics programs that supplement the mandatory curriculum.

A: Concept Map – Selected Example Developed for Bioscience Ethics

A concept map is a diagram, or graphical tool, showing possible relationships and is useful in the organization of particular ideas and knowledge. For example, the concept map depicted here refers to the plasticity of the human mind. The central theme or focus of this diagram is education. To this end the map provides a set of interconnecting relationships, ideas, and terms where each layer (ranging from the innermost to the outermost) can be readily linked back to its original focus. Students are invited to respond in three parts by providing links between EQ and ethics according to individual choice:

a) Consider the list of facets provided with each layer. These are suggestions rather than exhaustive lists, and you are welcome to use any of these in any combination in your essay, or devise your own (based on these examples).

b) State in your essay what you would title your outer ring (where it currently says “Observer’s Creative Space”). This should be at least referred to in the title of your essay or it may even be used as your essay title. Make a number of connections between your new outer layer and the other layers, based on how you consider they interact.

 c) Write an essay on how your chosen topic (the new title of your outermost ring) interacts through the connection(s) you have chosen from the Map (making sure to state what the connections are in the introduction of your essay).

Figure 1: Emotional Intelligence & Ethics - facets

- **Emotional or Limbic Brain** – interconnects with all outer rings and also connects exclusively with the sub-compartments via Functional Compartments (i.e. connected to = thalamus, hippocampus, amygdala, hypothalamus, pituitary gland).

- **Functional Compartments** – connected to = thalamus, hippocampus, amygdala, hypothalamus, pituitary gland.

- **Emotional Compartments** – connected to = perceiving emotions, reasoning with emotions, understanding emotions, managing emotions.

- **Measuring Emotional Intelligence** – connect to = self-awareness, assertiveness, independence.

- **Ethics** – connected to = innate, self-taught, learned, improved.

- **Ethical Behaviour** – connected to = social awareness, self-management, relationships management.

- **Observer’s Creative Space** – connected to = newly built construction.
B: Downloadable i-Lecture Course Series and DVDs

Subjects covered in this lecture series promote increased awareness of self within the environment. Modules 1-3 provide an overview of topics such as the treatment and causes of infertility, growth and maturation, parental behaviour and neonate biology and examines the effects of procreational biology on the foundation of human social structure. Modules 4-6 deal with reproduction as it relates to health and social issues and reinforces the role of biotechnology in the rapid advancement of human achievements in medicine and veterinary science. Topics include stress physiology, fertility control, teratogens, human dominated ecosystems and responsible global stewardship. Other topics emphasize lifestyle and health, immune regulation, and the state of wellbeing. To facilitate learning each module is separated by a series of questions or problems that the students are expected to discuss by participating on the discussion board. Discussion’s intention is to encourage thinking about what has been learned – the deeper the engagement, studies show, the better the retention. The overall gain is the opportunity to flexibly integrate and embed digital learning into the fabric of the entire curriculum. Bioscience Ethics & Reproduction (BIOL346) is organized and taught at Macquarie University by me.

Hard copies of PowerPoint slides can readily be packaged with the audio material for distribution, if desired.

LECTURE DESCRIPTIONS & LINKS

Module 1: Introduction to Bioscience Ethics & Reproduction
L1.1: Bioscience Ethics & Reproduction
The role of ethics in science and technology are explored using practical applications of reproductive functions in medicine.
YouTube link is as follows:
http://www.youtube.com/watch?v=HIMFQAEKwbo

L1.2: Human Origins, Natural Selection & Evolution of Ethics
Traces the evolution of ethical consciousness and relates how ethics impacts on modern science and its applications.
YouTube link is as follows:
http://www.youtube.com/watch?v=rSVqkVuGPJc

Module 2: Human Reproduction and Development
L2.1: Fertilization and the Initiation of Development
Provides an overview of human reproduction taking particular note of lifestyles, fertility and the ethics of preconceptional care.
YouTube link is as follows:
http://www.youtube.com/watch?v=TW1YGbjVC4Q

L2.2: Development and Placentation: Maternal-Fetal Communication
Traces the evolution of bonding, the establishment of pregnancy, placentation and epigenetic gene regulation heritable down the generations.
L2.3: Patterns of Human Growth  
Traces life cycle as defined by biological characteristics such as critical periods during development and factors contributing to intrauterine growth restriction and preterm births.
You Tube link is as follows:  
http://www.youtube.com/watch?v=D7b83yjZOoM

L2.4: Sex Determination, Brain Sex & Postnatal Personality Development  
Traces the foundation of adult sexuality in fetal life and explores the genetics of regular and 'hidden genders'.
You Tube link is as follows:  
http://www.youtube.com/watch?v=hcAfMrBDF_U

L2.5: Assisted Reproduction: At the Intersection of Ethics and Social Determination  
Experience a realistic simulation of routine medical assisted treatments available to couples seeking fertility assistance at an IVF clinic.
You Tube link is as follows:  
http://www.youtube.com/watch?v=bW0iFX7rTq0

Module 3: Gender, Sexuality and Social Aspects  
L3.1: GL1: Transgendered: A Personal Perspective – Katherine Cummings  
Introduces the evolution and wide-ranging bases of the transgendered as lived by an XY woman.
You Tube link is as follows:  
http://www.youtube.com/watch?v=OPSdQRUNP6E

L3.2: GL2: Gender Diversity – Gina Wilson and Katherine Cummings  
Traces current political activism supporting Intersex Rights and acceptance of sexual diversity.
You Tube link is as follows:  
http://www.youtube.com/watch?v=AyWiTaZe0eo

L3.3: Human Sexuality: Behaviour & Pheromones  
Describes the chemistry of attachment, desire, kinship laws and incest.
You Tube link is as follows:  
http://www.youtube.com/watch?v=sMSSHu9r7YI

L3.4: Sociobiology  
Describes the biological basis of social behaviour and fitness enhancing strategies such as sexual triggers and body image.
You Tube link is as follows:  
http://www.youtube.com/watch?v=fpAou13S4c0

Module 4: Considerations of Effective and Ethical Reproduction  
L4.1: Principles of Toxicology & Teratology  
Establishes a better understanding of the science of toxicology with special reference to human reproduction.
L4.2: Substance Abuse & Parenthood
Describes the physiochemical characteristics of drugs, the neuroendocrinology of addiction and socio-political responsibilities.
YouTube link is as follows:
http://www.youtube.com/watch?v=lM268WpvA18

L4.3: Fertility Awareness & the Aging Gamete
Causes of human congenital anomalies at birth are investigated from the biological, behavioural and bioethical perspectives.
YouTube link is as follows:
http://www.youtube.com/watch?v=nsK2ySJBpms

L4.4: Parental Behaviour & the Neonate
Early developmental patterns and physiological adaptation to extrauterine life are discussed.
YouTube link is as follows:
http://www.youtube.com/watch?v=gDHY6zwnwbU

L4.5 Stress and Adaption: Neuroscience & Neuroethics
The biology of stress from the perspectives of sickness and health, happiness and depression, advances in neuroscience and neuroethics are examined.
YouTube link is as follows:
http://www.youtube.com/watch?v=dbzzNi8ckw4

Module 5: Sustainable Ethics
5.1: Social Discrimination and Health Disparity Across Generations
Challenges social discrimination and health disparity in general and in contemporary Australia.
YouTube link is as follows:
http://www.youtube.com/watch?v=LU1xMSp41LY

L5.2: Population Growth and Economic Dynamics
Provides an overview of economic dynamics, sustainable population growth and modern approaches to fertility regulation.
YouTube link is as follows:
http://www.youtube.com/watch?v=4gpqXBDGFGo

L5.3: Human Dominated Ecosystems
Environmental priorities are re-evaluated and the effectiveness of multiple-entry bookkeeping, stewardship of Earth and the Gaia theory are assessed.
YouTube link is as follows:
http://www.youtube.com/watch?v=uwkRu9mj7LA

L5.4: Sustainable Peace for a Sustainable Future
Self-sustaining characteristics of the ecology of violence are challenged and whether modern warfare is fitness enhancing or a losing evolutionary strategy is questioned.
YouTube link is as follows:
http://www.youtube.com/watch?v=DJT4QDRSHAY
Module 6: Ethics In Society

Examines the ethical and political dimensions of policy development using case studies in fisheries and water management policy.
YouTube link is as follows:
http://www.youtube.com/watch?v=TIwiQq-b7mI

L6.2: GL4: Sustainability Indicators – Morgan Pollard
Reviews the bioethical basis of global limits, ecological economics and UN Millennium development Goals.
YouTube link is as follows:
http://www.youtube.com/watch?v=f_7CzmohBmU

Provides an integrated view of academic science, industrial science and military science to promote a better understanding of the ethical implications of scientific and technological developments.
YouTube link is as follows:
http://www.youtube.com/watch?v=7iARfSPcTDI

UNIT ASSOCIATED MOVIES

Below are two free-to-air public education movies which may be of interest.

“Lifestyle, Fertility and the Assisted Reproductive Technologies” describes how our life choices and reproductive health interrelate across the generations.

YouTube link is as follows:
http://www.youtube.com/watch?v=PE69WMmw8nU

“Marsupial Reproduction and the Conservation of Endangered Species” challenges human-dominated ecosystems, portrays kangaroos in the wild and presents examples of endangered species and captive breeding programs.

YouTube link is as follows:
http://www.youtube.com/watch?v=Bq0xxq49C6Q
Summary

As identified above, there exists an urgent need to reduce the gap in translating newly acquired knowledge from the bench to the classroom. With no secure, long-term solutions towards protecting our Global natural and cultural heritages, we must empower future generations to become sufficiently knowledgeable to best provide them with a safety net for survival. This proposal depicts a workable framework incorporating more fully ethical elements into existing educational programs as taught in science, medicine, law and economics. To facilitate reform, a commitment to update education and to expand the pool of individuals concerned about Global ethics would, of necessity, facilitate path-breaking discoveries and creative opportunities for social advancement. I am convinced that our newly created Education Department will enhance the pleasure of learning whilst increasing community accessibility to much needed ethics education. By working together to improve the available resources for learning, we will promote understanding and further endorse relevant themes crucial to modern bioethics. UNESCO can be a powerful and neutral platform where stakeholders with diverse backgrounds from all over the world get together to incorporate updated education materials and create adaptive change.

Resources and Publications with Useful Practical Information


