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BRIEF COMMUNICATION

Teaching and Learning about Bioscience Ethics with Undergraduates

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ABSTRACT *Bioscience ethics acts as a practical interface between science and bioethics. It links scientific endeavour and its application into adaptive forms of bioethical consensus. Its major elements are increased understanding of biological systems, responsible use of technology, and curtailment of ethnocentric debates in tune with new scientific insights. This paper briefly describes the students' learning experience gained from the vacation unit BIOL 240, Introduction to Bioscience Ethics, as taught in biology, Macquarie University. On the basis of our evidence students were overwhelmingly positive about their learning because the unit assisted them to better face dilemmas that arise from the application of science and technology. The structure also provided active engagement with the subject matter and preferred learning environments that supported and contested their understanding of concepts relevant to bioscience and bioethics.*

KEYWORDS *Bioscience ethics, bioethics, ethics, learning and teaching, undergraduates, learning and teaching preferences.*

Why Bioscience and Bioethics in the Classroom?

Traditionally, undergraduate biology teaching has over-focused on the acquisition of facts, principles, concepts and processes, whilst minimising what needs also to be taught about our global technological-based dilemmas. Bioscience and bioethics should be taught alongside an understanding of the modern sciences because science, more specifically biology and medicine,

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have contributed significantly to culture and society as a whole thus influencing everyday life. When science is applied in society, its function is no longer just for knowledge as the focus shifts, incorporating functions that expose value judgements and political forces. For example, the Human Genome Project and Human Genome Diversity projects are powerful forces in modern societies, as are cloning, somatic and germ line therapy technologies. Access to genetic and sequence maps has altered the face of clinical medicine in the 21st century. Bioinformatics—the data storing and handling of human genetic information—is big business in the timeframe post the sequencing of the human genome. The validity of new technologies for human reproduction, ownership of one's own genes, gene patenting, privacy and discrimination issues are being raised and debated. Debate is healthy but it is only useful if all participants understand the fundamental biological principles underlying human life, human parenthood and environmental needs. The science of today cannot be separated from its application in society; thus bioscience and bioethics cannot be separated either. To quote Cleminson, "Scientists study a world from which they are a part not a world from which they are apart" (Alters, 1997, p. 41). Consider, for example, global warming and climate change or nuclear power. The global community must agree on some bioethical consensus when applying the contributions from science. It is essential to consider, therefore, modern scientific and technological applications alongside some measure of ethical consensus. We need, as a society, to keep track of powerful technological advances despite the benefits associated with these gains.

Introduction to Bioscience Ethics

As illustrated above, it is absolutely essential to consider scientific research and technological applications alongside ethical consensus. Knowledge is empowering and informed decisions can be made only if one is cognisant. Bioscience ethics encourages individuals to access not only the extreme viewpoints, but the complete range of ethical concerns such as the right to be free from preventable disease, the right of every child to be wanted and the right to express one's genetic potential. Examples of other scientific developments requiring intense ethical consideration include recombinant DNA technologies, therapeutic cloning, gene therapy, proteomics, pharmaceutical therapies and nuclear technologies, to name just a few current topics discussed in the course. In summary, the unit seeks to heighten students' awareness of current bioethical issues raised by biological research and its technological applications so that all students, irrespective of background, are able to come to both an informed opinion and/or decision about relevant issues. Diversity and discord of beliefs, attitudes and values are encouraged and explored by both students and teachers.

Each day consists of formal structured lectures given by the unit coordinator (Pollard) and several guest lecturers who are experts in their respective fields, along with problem-based learning conducted in student groups. This provided a variety of approaches and opinions. After each lecture, students were given ''real life'' examples of regional and/or global concerns and asked to debate and discuss these hypotheticals in groups of four to six with a view to presenting their ethical analysis back to the class. In addition, students were asked to choose their own topic of interest and as a group present this in a creative fashion to the class. Assessment was of two parts—group presentation and individual performance (50%) and take-home examination (50%) with the distribution of final grades awarded as required by university regulations.

Evaluation and Findings

The unit was first taught in the summer of 2000 with 40 enrolments from various departments across the university including biology, chemistry, early childhood, economics, education, environmental studies, geology, statistics, law and women's studies. We wanted to garner sufficient information to begin to understand students' responses to the unit in terms of their rationale and expectations, the depth of interest in the nominated topics, their preferred learning and teaching styles and any other themes resulting from a fine grain analysis of the data. This would enable us to develop an understanding of how our students perceived the unit and from this, allow us to flexibly tailor the unit to student needs. Findings from the first student cohort from the summer 2000 are reported here. For these reasons we collected four data sets—a *pre-unit* survey; *post-unit*, non-identifiable, written critiques; a teacher evaluation questionnaire administrated and analysed by the university's centre for professional development, and finally, semi-structured interviews with 10 volunteers after grades had been awarded.

What we as teachers in this unit have learnt is that if we choose topics which meet the stated aims of the unit, then many of our students believe that their understanding of the subject matter is enhanced and that their level of critical thinking moves beyond their present level of expertise. Students expected the unit to be challenging and to provide them with windows of opportunity to broaden their understanding of scientific and technological change. For example, the discussion of issues in formal lectures and in tutorial groups stretched their thinking in ways they had not encountered previously. This is exemplified in the following interview comments:

> There was more in it than I thought or realised it made me think about a lot of things that I would not have thought of or would have chosen not to think of we were made to think about things. (Student 10, biology)

We also were made aware by our students that topics which were familiar to them when presented in unfamiliar contexts allowed them to focus upon

alternative learning frameworks. For many of the non-biology students understanding biological facts and concepts posed no difficulty. What all students found most rewarding was a deeper appreciation of the complexity of biological systems and the demands bioscience ethics places in the search for responsible bioethical consensus. As one student wrote in their critique:

> It [Introduction to Bioscience Ethics] has been successful in ''turning my world upside down''. I have learnt to perceive ethical issues in a relational framework. It has consequently challenged and questioned my taken-for-granted cultural viewpoints. The structured lecture material, group discussions, guest lecturers and visual stimulation challenged my thinking by introducing me to the complexities involved in scientific and ethical conflicts, and has made me realise that my ''common sense'' cultural assumptions were not always equitable and applicable across different boundaries. (Student 22, environmental science)

We were made aware of the intrinsic interest and controversial nature of some of the topics influencing our students' learning performance. For example, for learning to take place teaching must be structured to stimulate student interest and intellectual curiosity. A surprising finding concerned students' assessment. The take-home examination was for some students who were interviewed a novel experience that was, in retrospect, positive.

> I had never done one [take-home exam] and I did not know what to expect and I tend to do really well during semester with essays and assessment but I am a bundle of nerves at exams so for me [pause] still having the exam but not all the pressure that went with it, I found for me that was good. (Student 18, geography)

However, the student group did make several constructive comments about the unit in terms of content and the management of group discussion. These students felt that some peers had not paid sufficient attention to the unit readings, there was too much ''political correct thinking going on'' during debates and the voices of more articulate students were heard above the rest of the group. One student lamented the fact that she had chosen to remain with issues with which she was more familiar and therefore had not fully appreciated the value of the unit. We are addressing these concerns with each subsequent student cohort.

Conclusion

Ethics alone is stagnant—rather it is important to use the existing ethical framework to weigh up the risk of harm against the intended benefits of any

new technology. The bioethical issues are not novel as they still relate to ''love of life''—the technologies are. It is for these reasons that bioethics and science should be considered in unison. People who are ignorant of the scientific processes involved cannot reach an adaptive ethical decision. Bioscience ethics removes itself from the bioethical discourse but acts as a friendly neighbourhood watch to ensure that those without a scientific background do not corrupt science.

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