AC 2011-379: THE ASSESSMENT OF ETHICAL AND SUSTAINABLE ENGINEERING STUDIES IN UNDERGRADUATE UNIVERSITY EDUCATION

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The assessment of Ethical and Sustainable Engineering Studies in Undergraduate University Education

Abstract

This paper reports on a 4-year cycle of action research to develop and refine a method of assessment for an engineering studies paper that contains both ethics and sustainability education for undergraduate engineering degrees at the Auckland University of Technology (AUT) in New Zealand.

At the inception of this ethics module in 2006, the assessment procedure consisted of assignments, group project-work report, group oral presentation and examination to assess student learning. This assessment gave the usual multiple indicator perspective comprising a range and balance between written, oral and work-produced-report assessment.

However, the assessment focus was shifted from empirical assessment methods as a test of memory using the quantitative aspect of remembering facts, systems and procedures, to a qualitative aspect of conceptual understanding, and explanation. This shift included both formative and summative assessment scheme, in which some of the work could be subject to interpretation of the ethical theory when applied to case studies, rather than assessment of empirical facts and procedures which may be constrained to a teacher's implicit development, interpretation and assessment of the syllabus content.

The assessment procedure was redesigned in 2008 for classes of 150 plus, comprising a formative assessment and feedback through essays, a formative feedback by the in-class case-studies and summative assessment by examining the major case studies and their understanding of the course material in a final examination.

Introduction

To receive accreditation of undergraduate engineering degrees the Institute of Professional Engineers of New Zealand (IPENZ) expects AUT to meet the requirements of the Washington and Sydney Accords with the incorporation of ethics, sustainability and the relationship between engineering and society into undergraduate engineering curricula.[11]

A literature review established that there were no national guidelines detailing such syllabus content or process and consequently, the incorporation of ethics and sustainability education into engineering education will vary from one institution to another. To begin the curriculum development, literature was further explored for academic views, perceptions and experience, and sought to understand and interpret the factors that influenced these views. However, the research revealed no documentation of an established curriculum.

Before implementing an assessment schedule, the curriculum design was decided, with a plan of exactly what it is that the students were expected to comprehend. Engineers and engineering students are accustomed to scientific/factual knowledge and can find it difficult to make the shift to the social sciences and to philosophical issues (both with regard to ethics, sustainability, and to education). This paper discusses some of the issues faced in making this shift.

This research, based within the interpretivist paradigm, used qualitative data to identify the various options available for the teaching and assessment of ethics and sustainability in relation to engineering. The reviewed literature revealed many options, and changes were made to the inaugural curriculum design as the module evolved over a four-year period. This ongoing development is described as *action research*. McNiff promotes the action research method for use by individual educators to improve their own practice in teaching as a regular cycle of self-reflection and course appraisal.[17] Consequently, the stages of action research cycle – observation, review, plan and activate – involved lecturer observation and reflection, coupled with a combination informal feedback, and the more formal formative and summative student appraisal.

Project Goal

The project goal was to design and assess a curriculum relevant to an undergraduate engineering programme which would include several responsibilities relevant to engineering practice:[12]

1. Teamwork.
2. Communication.
3. Societal, health, safety, legal and cultural issues.
4. The relationship between engineering and society.
5. Professional ethics.
6. Sustainable development.

The curriculum was designed to contain enough theory for engineering students to understand the concepts of ethics and sustainability, while endeavouring to keep their focus and attention before discussing the ethical and sustainable issues of good engineering design and practice. The content would include:

1. Introduction to the social responsibilities of engineering.
2. Technology and society – the relationship.
3. Social engineering and society development.
4. Moral theory.
5. Ethics in decision-making.
6. Modern engineering decision-making.
7. Codes of ethics.
8. Ethics in engineering research.
9. Sustainability.
10. Application of sustainable engineering.
11. Eco Efficiency, Cleaner production.
12. Sustainability indicators.
13. Industrial ecology.
14. Design for environment.
15. Life cycle analysis.
16. Engineering case-studies.

Within this curriculum content, the overarching academic objective was to facilitate informed thinking, to develop an intellectual independence and foster the ability to reason and think logically about issues that may confront students during their engineering career. Technical rationality is inevitably entwined and complicated by social values and this engineering

studies curriculum design is intended to facilitate the development of moral, ethical and sustainable integrity, where students are encouraged to explore possible alternatives beyond the knowledge and constraints of the actual situation with an ability to make value-laden, ethical and sustainable judgement in the world of engineering industry and commerce. Most importantly, the curriculum needed to be accepted and embraced by the students, rather than be viewed as a soft subject or a waste of time.

As developed, the curriculum is not rigidly or exclusively postmodern – a term with multiple and subjective meanings depending on whether it's used for architecture, art, clothing or the social sciences. In relation to education, postmodernism may include a shift towards *axiology* (or value) in education. In this module the intention was to:

1. Shift the learning process from the quantitative towards the qualitative;
2. Move from the modernist approach to engineering education towards a fluid and flexible means of examining and comprehending issues socially, technically and related to good engineering practice;
3. Provide an approach that does not impose a rigid set of values on the students, but encourages them to understand their own values, appreciate the values of others and understand the values in good engineering practice.

Educational approach to these assessment goals

The method of curriculum delivery was an important decision which would affect how the paper was assessed. The immediate challenge was the implementation of a new syllabus with a teaching approach to present the subject theory in a way that was stimulating and relevant to engineering.[5]

For the timing of the teaching, there are currently two popular curriculum delivery options, *stand-alone* or *across-the-curriculum*. The stand-alone format comprises a separate course or module of tuition, whereas in the across-the-board format ethics and sustainability are progressively introduced throughout the degree programme, deliberately immersed into other subjects. To introduce an ethics curriculum across-the-board necessitates the co-operation of other lecturers and is gaining in popularity, but in this 2006 paper, the availability of one dedicated lecturer was a compelling justification for the stand-alone format at that time.

More importantly, the most salient decision was how to teach the subject, which would effect how the paper was assessed. Much of engineering education involves teaching quantitative and factual engineering material which may be justified with empirical evidence, but Habermas cautions teachers against such a teaching approach to ethics.[10] Ethics education is seen by many academics as enabling people to think for themselves[13] where the lecturer takes a facilitator's role in ethical education, fostering critical awareness and developing students' capacity to "examine an interpretation – especially one of their own – and develop alternatives to it".[3]

Newberry warns that "ethical instruction runs the risk of being only superficially effective".[21] There is a difference between intellectual and emotional engagement and Newberry suggests that teachers should strive for the former. Gorovitz also makes the point that "anyone can conduct a meandering discussion of some ethical dilemma or other or can ruminate aloud about ethical conflicts faced and conquered".[8] Gorovitz warns the novice that in this case

"the subject is in danger of being reduced to a glorified bull session of opinion swapping, to etiquette, to good advice or merely a fig leaf for conferring respectability".[8]

Hence, the literature review revealed the need to avoid such a relatively superficial and peripheral treatment of the subject. Furthermore, such a teaching approach would be difficult to assess.

At the other extreme, an engineering curriculum that was totally *referent-centred knowledge* with a compartmentalised teaching approach of separate areas of inert knowledge, from which the students could essentially be assessed on a collection of facts. Such an approach would be inadequate for ethical and sustainable decision-making in situations of uncertainty where judgement is required.

Consequently, the teaching implemented was based on *problem-centred knowledge* where the knowledge was complemented by the practice where the students can relate the theoretical information to practice. This theoretical learning structure encourages the students to think. The emphasis in learning was not simply an absorption of information, but involved having to use thinking skills to construct knowledge.[18] Stephenson refers to this as giving students capability education.[23] To embody this concept in teaching practice, Installe recommends moving the teaching emphasis from passive lectures towards more active, participative, project-oriented teaching methods.[11] To achieve such an objective, many researchers promote the case-study as a useful teaching method for group decision-making. Davis and Installe both suggest that supplementing the experience of real-life ethical dilemmas (case-studies) with a programme of theoretical learning is an ideal educational tool to assist with understanding.[4,11]

Using the case-study format as a teaching tool, the adopted approach involved several sessions on incremental theory, followed by case-studies with practice in problem-solving involving the critical analysis of case-studies containing identifiable flaws in process with the opportunity to learn in reflection by the experience of others.

Andrew and Robottom advise teachers not to attempt consensus in classroom consideration of ethical and sustainable issues, because, unlike referent centred case studies, the application of case-study critical analysis within the ethics-based or sustainability case-studies may conclude with a judgement subject to interpretation and values.[2]

Adopting this approach, the assessment must also be subjective, (or subject to interpretation) of the theory. To achieve this, Morgan suggests a *deep approach* to the teaching.[19] Morgan describes the *surface approach* (referred to by some educators as a shallow approach) as an intention to treat the curriculum as an external imposition, where the students simply complete the learning tasks required to meet the demands of assessment, which may include memorising information and procedures. Morgan challenges teachers and curriculum designers to improve student learning with a *deep approach*, which implies an intention to understand rather than memorise facts to be recalled at some later point in their study or career.

Zimmerman and Schunk promote an educational approach that teaches people how to evaluate the information they have before them, and to make decisions that are ethically sound.[25] The teaching of ethics and sustainability can be undefined and indefinite (inhabiting *grey areas*) and the concept of knowledge is constructed and validated by people, and as

such, it may be a product of the social environment within which these people participate.[25] Knowledge construction situated within their own social meanings and interpretations would depend on many variables within this social context, where students examine and develop an understanding of why past decisions were made.[15] Many lessons are learned in practice and one can learn from the experience of others. McMillan points out that "there is no substitute for experience, whether it is your own or someone else's".[16] Garvin found that experiential knowledge construction is most effective when it is "situated and grounded, linked closely with concrete activities and experience … [it is] far more likely to be understood when linked to familiar contexts, setting and environments".[7]

The fundamental theory was covered first after which the students were divided into groups to collectively conduct a study of high-profile cases, which gave them the opportunity to work, critique and discuss. Examining these high-profile case-studies provided reinforcement of the theory and the responsibilities of engineering decision-makers for good practice.[20]

Having adopted such a teaching approach, the ensuing objective was the assessment of the paper.

Assessment method

To assess the paper, the intention was a range and balance between written, oral and work-produced-report assessment, where the assessment focus shifted from empirical assessment methods as a test of memory using the quantitative aspect of remembering facts, systems and procedures, to a qualitative aspect of conceptual understanding, and explanation. Such an assessment procedure made it possible for more than one acceptable answer or problem solution. The assessment plan included both formative and summative assessment schemes as a three-tier assessment process of assignment, case-study and examination in both ethics and sustainability. The assignments provided a formative evaluation by way of corrective feedback.

Results of the project

The plan for the 2006 assessment comprised:

Two assignments consisting of essays:

1. Assignment 1 - technology and society, and a group of questions relating to engineering ethics.
2. Assignment 2 – sustainability.

These assessments were intended to be summative in terms of the early part of the syllabus, but could be of formative assistance to the students, provided we made the effort to mark and return them promptly.

1. Two group case-studies (one each in ethics and sustainability) as summative assessment which would involve teamwork. Each group was required to present their findings to the class and submit a written report for marking. Allowing the students to choose their case-study subject ensured the curriculum was not teacher-dominated

2. A final two-hour summative assessment examination combining both ethics and sustainability. The two sections of the examination would each be half of the 60 marks.

The marks for grading purposes were as follows:

Ethics assignment	10
Sustainability assignment	10
Ethics case-study	10
Sustainability case-study	10
Two-hour examination	60
Total	100 marks

In the second year the process of group case-studies continued and the students were able to benefit from the class presentations of all of the group findings. However, because of the increased numbers, the presentations were taking much more time.

At the end of 2007 the dynamics involved in group decision-making when trying to assess the individual learning achievement presented questions. Vygotsky offered the social-cultural theory, which holds that socially mediated activity can be an influence on the thought process, where the thought process can be influenced by the social environment a student is in.[24] Learning is context-dependent – what is learned and what is valued being dependent on the situation and context, and these are a major influence on students' perception of ethics and sustainability.[6,22]

The social environment is a peer influence where people can be swayed by compelling circumstances or emotional factors in the group environment to conform. This contributes to the value of group learning within the class. The learning that takes place in group discussion may include the recognition of, and seeking to understand the existence of, disparate views, and may involve reasoned discussion about them. However, whilst this is one of the objectives of group work, a group report with a collective view may not necessarily represent all the views of the group.

This evolved into an intriguing question: Do the people in group work recognise, state, justify and evaluate the ethical assumptions which underlie their decisions, or do some mimic, chameleon-like, the thinking, opinions and cultural context of the most influential team member?

Consequently, while it appeared that group discussion in class reinforced the process of learning, a formal out-of-class study and group report may only represent the views of the most influential individual or the majority culture of the group. The concern here is the difficulty in assessing individual comprehension of the case-study.

Growth in class size

AUT's growth as a university was reflected in 2008, where the number of students had grown to over 150. While this is not a large class by international university standards, in terms of assessment, it was difficult to assess the performance of individuals within each group. As the groups had become larger, some students were reported by other students as putting in very little effort, to the annoyance of others in the group.

Consistently the membership of the groups was the same for both project assignments in the paper. Observation revealed that these groups tended to evolve natural leadership within the group, which may not necessarily give all of the students in the group the competence to initiate, conduct and manage a project on their own initiative. It was difficult to judge whether all the students were experiencing any progression in these skills.

In 2008 the use of small case-studies and discussion points were introduced to complete the learning cycle each week. This provided a critical reflection approach where the actual learning was followed by active review to reinforce positive and beneficial aspects of the learning experience. This appeared to benefit students as a partial means of formative self-assessment, where they could assess their learning and ask for help.

However, although the final summative assessment by way of examination was successful, there were incidents of anger expressed by some students at the lack of participation of some group members in the case-study presentations and reports. In several cases, a group member was expelled from the group and received no marks for the assessment. Questions arose about the value of this form of assessment:

1. The group case-study method of assessment became unwieldy.
2. It was very difficult to assess an individual.
3. It provided no formative feedback, as the reports were marked at about the same time as the final examination.
4. The time taken to present to the rest of the class was such that students were not staying for, and benefiting from, other class presentations.

However, the students enjoyed the challenge of learning in class through case-studies, and, as part of the learning cycle the in-class small case-studies were an educational enhancement.

The minor case studies were used throughout the paper as discussion points facilitating a formative feedback. The major case-studies were now also presented in the classroom where, after a class discussion of the material, the students would divide themselves into groups for discussion and input. The collective opinions of the students were entered into the PowerPoint presentation and posted on the student online database for access by all students. The major case-studies were now examined in the final examination which was extended from the earlier two-hour examination to three hours. The students knew in advance that they would have to comment on one of three familiar case-studies as part of the final examination, which they were expected to research prior to the examination. The marking schedule was now:

Ethics assignment	15
Sustainability assignment	15
Three-hour examination	70
Total	100 marks

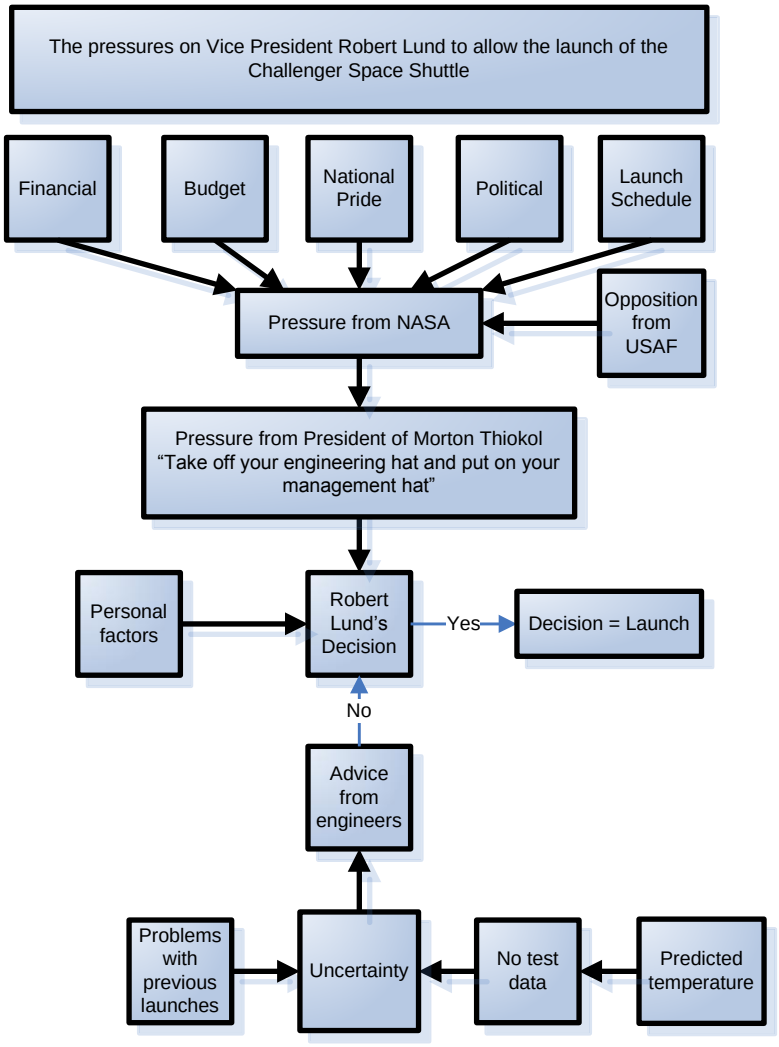
In the examinations over the previous three cycles it had been noted that the students' responses to questions were as much influenced by their social situations in terms of value issues, social etiquette and cultural laws as much as by the theory they had learned in the ethics and sustainability module. The students were thinking and interpreting information for themselves.

The 2009 procedure of individual assessment of group studies in the examination provided the means to gauge the understanding of the individual student in the case-study. Whichever viewpoint a student took, they were expected to explain and justify their opinion using theory where possible, and the resulting assessment of individuals now appears to be more accurate than the collective views of a group case-study report in the earlier years. The new examination system was particularly successful for those who attended the classes and took part in the discussions on the case-studies.

Example of ethics case-study assessment

Question – NASA

Readers please note: This diagram is not given in the exam.



A Vice President of Morton Thiokol, Mr Robert Lund was the engineer required to give final approval before NASA could launch the Challenger space shuttle in its final and fatal flight. As an engineer, he was instructed:

> *Take off your engineering hat and put on your management hat*.

Discuss the weighting factors which it is understood he had to consider before making the decision to allow the launch to go ahead, and categorise (in your opinion) his final decision in terms of Aristotle's Virtue Ethics Theory.

What improvements have been made to the IPENZ Code of Ethics to improve engineering decision-making and avoid a disaster like this in the future?

Examples of non-case-study ethics assessment

- Define the following
    a. *Consequentialism.*
    b. *Utilitarianism.*
    c. *Existentialism*. (3 marks)
- Explain the importance of *etiquette* in the engineering work place. (2 marks)
- Explain what is meant by *treating people with dignity in the engineering work place*. (1 mark)
- Explain the difference between *values, morality* and *ethics*. (3 marks)
- Explain the principle of *existentialism*, and the limitations the theory has as on you an engineer in the work-place. (3 marks)
- When considering Aristotle's virtue ethics, state the difference between an altruistic decision, a utilitarian decision and an egoistic decision. Give an example of each. (6 marks)
- Under the Hobbes, Locke and Rousseau Social Contract Theory a citizen has *alienable* and *inalienable* rights. Give an example of each. (2 marks)
- When considering an engineering decision, explain the difference between *idealism* and *realism*. Give examples. (4 marks)
- When undertaking research in a university, state when it would be necessary to apply for *ethics approval*. (1 mark)
- State two important *consequentialist* factors that are considered by the IPENZ Engineering Code of Ethics to be a moral imperative during the engineering decision-making process. (2 marks)
- An example of non-consequentialism is *deontology*. State how a deontological decision differs from a consequentialist decision and give an example of each in engineering decision-making. (4 marks)
- An engineer who is employed in your company is judged to be unethical because of an apparent *conflict of interest*. Give an example of what could be judged by your employers a conflict of interest. (1 mark)
- A group of students are sharing a joint engineering research project at AUT. List four important ethical considerations that should be carefully checked before the group's joint research report is submitted for examination. (4 marks)

- An engineering manufacturer is accused of *plagiarism* in the marketing of a product. Give an example of what could be considered plagiarism. (1 mark)

- Some scientists and technologists claim that the relationship between technology and society is *neutral* (or amoral). Some people disagree and view the relationship quite differently. Explain your position in reaction to this statement and explain why. (5 marks)

- Categorise these two decisions in terms of *ethical decision-making* and explain the rationale of your opinion:

    a. Captain E J Smith went down with the ship.

    b. The Chairman of the White Star Line Mr Bruce Ismay saved himself in a lifeboat

- The relationship between technology and society is such that many scientists and technologists claim *"society must control technology"*. Explain this statement and give two examples of how society has been affected by each of the following;

    a. The implementation of effective controls.

    b. An absence of any control. (5 marks)

- When considering an engineering decision, the outcome of the decision may be predicted with either:

    a. Certainty.

    b. Uncertainty.

    c. Risk.

    d. Ignorance.

    Discuss each of these possible outcomes in relation to ethical engineering decision-making. (4 marks)

Examples of Sustainability case-study assessment

Answer THREE of the following four questions.
All questions carry the same marks (10 each).

1. You work for an engineering consultancy firm who has been approached by a major Capital Fund Investor, seeking to invest in technology developments that will assist in the development of new forms of energy supply on a large scale.
   There are five possible technological proposals that are being considered by this investor:
   a. Gas Hydrates.
   b. Wind Power.
   c. Water Power.

d. Solar Power.
e. Nuclear Fusion.
You are to choose one of these five, which you believe could be a viable investment, with the most likely chance of successful implementation and outcomes.
Firstly, describe your chosen technological proposal, explaining how it would work. Then discuss its strengths and weaknesses, especially noting any particular opportunities which might be opened up as a result of its development, and any particular problems that might arise from its implementation.

2. Consider the past 60 years in the timeline of the development of sustainability in the world. Choose one particular 'adverse event' that has occurred where significant environmental damage resulted (or had been occurring. Think about any positive outcome that may have occurred as a result of addressing the environmental issue you have chosen.

   Describe the initial cause of the 'adverse event', what actually happened, what the aftermath was, and your chosen positive outcome that came from it.

3. Humanity's ecological footprint is now believed to be so large, that it takes the earth one year and four months to regenerate what we use from it in a year. Applying the principles of 'reduce', 'reuse', and recycle, describe an example of how we could act differently, in order to reduce our ecological footprint in each of the following areas: (i.e. a different example for each of a), b) and c)).
   a) Production.
   b) Consumption.
   c) Organising ourselves.

4. Choose one of the following three case studies covered in class. Describe some practical solutions that could overcome the issues faced by the identified organisations, giving explanations of why you think they would be effective:
   a. Environment Waikato, which has to find ways of dealing with increased non-point discharges of nutrients used in farming activities. These are leaking into the Waikato River, and degrading the water quality, impacting on both Tourism activities and provision of good quality water to its major customers.
   b. Watercare Services Ltd which is responsible for supplying bulk clean water to the Auckland Region. It is facing increased levels of toxic chemicals, such as arsenic and mercury, particularly from the Wairakei geothermal power station activities, in the Waikato River water it is using.
   c. Sony Electronics, which has publicised its encouragement to consumers to take their old electronic devices to its waste management centres for recycling. If it attempts to handle the recycling of these goods in its major customer areas such as the USA and Europe, it faces huge costs for storage space and item breakdown to extract metals and electronic components for reuse, as well as management of the toxic by-products and waste from the process.

Examples of Sustainability non-case-study assessment

- Briefly define the term *Sustainability* and explain why it is important to move towards a sustainable society. (1 mark)

- The Greenhouse effect is a term used frequently in relation to climate change. What is the major cause of this *Greenhouse effect*, and why is it of concern to environmental scientists? (1 mark)

- Explain what is meant by *life cycle* considerations in the design of engineering applications. (1 mark)

- Describe the concept of *Cleaner Production* (CP), and give an engineering example of where this can be applied. (1 mark)

- Name three of the *six barriers to producing differently*, and give an example of each. (3 marks)

Conclusion

The subject can be examined in diverse ways and goal was the adoption of a tangible approach to assessment. The motivation to learn in a degree programme may understandably be linked to the motivation to pass, and the traditional system of formal examination facilitates this, but the motivation to learn, remember and pass is not necessarily the motivation to comprehend. Rather than the transmission of a pre-established canon of knowledge, the aim was to introduce ethics and sustainability education with a movement away from the traditional *learn and regurgitate* procedure to the concept of collaboration and interaction by an understanding of the interrelatedness and interdependence of society and the physical world. As explicit items for final examination, the case-studies ensure that the process of analyses (particularly in the ethics section) has shifted the focus of examination preparation from the quantitative aspect of remembering facts, to the qualitative concept of conceptual understanding

The assessment began as a manageable procedure for small classes, but changes were driven by the necessary efficiency of handling larger classes. As a result, the examination of the case-studies evolved to be included in an extended final examination. The assessment process allowed students' opinions to be embedded into the learning environment and the final examination that evolved sought student opinion based on their learning in order to gauge the levels of understanding and the ability to reason and think laterally. The strategy for increasing the motivation to understand has involved an increase in the examination of analyses and the more recent case-study assessment procedure gave the process of analysis an enhanced degree of seriousness and focus. An unanticipated and welcome side effect of this system of assessment was the incentive for the majority of students to come to class.

The assessment produced a balanced assessment procedure suitable for this size of class. There was formative assessment and feedback through the essay and formative feedback by the in-class case-studies, followed by a summative assessment by in the final examination. The revised examination format has provided a more accurate assessment of individual learning.

The requirements of such an assessment scheme that provides alternative ways of responding can create labour-intensive demands on staff, and may limit the outcomes. A possible inhibiting factor of this assessment is a combination of the practicability of assessment administration and the reluctance of teachers to mark the subjective, as the assessment scheme created labour-intensive demands on staff, and reluctance by some staff members to mark essay-type answers may limit the outcomes of such an assessment schedule.

However, in 2011, there have been changes to the requirements of the Washington and Sydney Accords, which require ethics and sustainability to be embedded across-the-board into all undergraduate engineering papers. This may lead to new developments and ideas and a rethinking process involving re-engineering the way we deliver and assess these programmes. One observation from this research experience is that the teacher requires development time, time to manage their curriculum and teaching strategies, time to implement changes, and time to reflect on their success (or shortcomings) through student outcomes.

Naturally teachers have their own distinctive ways which predispose them to think and teach in particular styles. While teachers are entitled to this academic freedom in the classroom[1] it could be construed by some as unethical for a teacher to impose their personal moral or cultural values onto the students.[11,14] There are of course schools and universities in many countries with a direct association to specific religions or cultures, but AUT does not have such an affiliation and the teaching should remain culturally neutral. Even so, in some respects to be neutral on a moral issue can be construed as having another opinion. The obvious dilemma here is that even a neutral educator who takes no side in an issue may represent a stand of retaining the status quo, which may involve steering the issue in some direction.

However, educators should be cautious with such an open and neutral approach. Although the ideal of academic freedom is to promote the free expression of ideas, university educators should be careful in the education of ethics to be ethical themselves. This of course does not mean that as tertiary educators, university staff should be value-free. In fact, "no curriculum is value-free … a teacher's values will directly influence what is selected for study".[2]

The risk in this style of teaching and assessment is indoctrination and it is important to avoid this. In the most simplistic of terms, the only culture we should assess is a professional engineering culture and an engineering code of ethics. The emphasis should include future-relevant behaviour skills in industry and how they as engineers must fit into that society in a professional manner. As potential professionals it is important that they graduate understanding that while ethical engineering behaviour can establish trust and respect from the society they serve, conversely unethical and unsustainable engineering decision-making can lead to organisational dysfunction, public outrage and personal moral dilemmas.

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