INTERNATIONAL CONFERENCE ON ENGINEERING DESIGN, ICED'09
24 - 27 AUGUST 2009, STANFORD UNIVERSITY, STANFORD, CA, USA

TEACHING ETHICS IN DESIGN: A REVIEW OF CURRENT PRACTICE

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ABSTRACT
This paper reflects on the findings from a benchmarking study which investigated current approaches for teaching ethics to designers and engineers. The research has been carried out as part of a one year Academic Practice Award which is being delivered by staff in the Department of Design and Technology at Loughborough University (June 2008 – June 2009) and aims to develop new teaching material for teaching ethics via blended learning. Although the teaching of ethics is recognized as being important in design and engineering, the practice of doing so has only become established in the last five years and only by a limited number of institutions. This paper presents the types of issues that are currently being taught to students on a range of different types of design courses in the US and Europe. It also draws on the literature to reflect on additional methods which might be appropriate for teaching ethics in design. The lessons learned will be fed into the development of new material for integrating ethics into the teaching of design and technology students.

Keywords: Ethics teaching, product design

1 INTRODUCTION
This paper reflects on the findings from a benchmarking study which investigated current approaches to teaching ethics to designers and engineers in a classroom environment. Although it is acknowledged that work based learning in the form of internships or placements can be valuable, the purpose of this study was to gather appropriate techniques to feed into a taught module. The research has been carried out as part of a one year Academic Practice Award which is being delivered by staff in the Department of Design and Technology at Loughborough University (June 2008 – June 2009) and aims to develop new teaching material for teaching ethics via blended learning. It was driven by the need to incorporate a new field of ethical issues which have emerged through the study of 'Design for Behavioral Change' [1, 2]. Ethics is "a rational, consistent system for determining right and wrong, usually in the context of specific actions or policies" [3]. It can be approached in different ways. A *deontological* approach is rule-based and often has one overriding principle, focusing on rules not consequences [4] and is based on "universally applicable laws that hold for everyone in any situation" [5]. A *teleological* viewpoint can be characterized by the phrase "the end justifies the means" and focuses single-mindedly on reaching the end point, less consideration is given to the means used to achieve those ends [4] A *utilitarian* viewpoint can be epitomized by the phrase "the greatest good for the greatest number"[4]. *Act-based utilitarianism*, which can be thought of as "pro and con" ethics, evaluates "the ethics of any action by gauging its consequences with respect to a particular criterion" e.g. happiness or well-being [3]. *Rule-based utilitarianism*, on the other hand, suggests that "ethical rules only [apply] if *always* following them results in more compelling benefits" (ibid). A *consequentialist* approach "looks to the future and considers how to act in order to reach a situation of the best consequences' for our decisions" [5]. The focus of this approach is to investigate the potential effects of our actions which are then assessed against certain values [5]. Up until the early twentieth century, ethical debate was mainly concerned with ethical theories, however in the mid-twentieth century the debate broadened to encompass the application of ethics [6]. It is *applied ethics*, which involves examining specific controversial issues through applying ethical theory to real-life situations, upon which this paper and the project focuses.
The importance of ethics in engineering is well established [7] and supported by teaching materials for those studying or practicing in this field [8, 9]. The need for ethical conduct in engineering is also reflected in standards expected of graduate engineers. The Engineering Benchmark Statement and UK

SPEC, for example, state that graduates should "be aware of the social, cultural, environmental and wider professional responsibilities they should display" and "when faced with an ethical issue, they will be able to formulate and operate within appropriate codes of conduct" [8]. In 2005 the Teaching Engineering Ethics Working Group of the Royal Academy of Engineering and the Engineering Professors Council developed a curriculum map to advise academics on how ethics could be integrated into undergraduate engineering teaching [9]. Suggested topics include (amongst other things); professional practice, codes of conduct, differentiating between good and bad employers, an introduction to the theory of applied ethics, analysis of ethical cases in engineering and methods for auditing ones own projects. Suggested techniques include; practical exercises, application to a student project, role playing scenarios, group debates which challenge students to defend an ethical standpoint, hands-on practice in solving morally ambiguous scenarios and the presentation and analysis of case-studies.
In order to ensure that the content to be developed through this Academic Practice Award is suitable, competitive and based on the latest thinking and that the methods by which it is taught are interesting and effective, a review into how other institutions teach ethics as part of design or engineering programmes was undertaken. In Section 3 the types of topics taught within different types of design courses will be reflected upon. Section 4 will then consider the types of mechanisms for delivering this material and Section 5 will draw some conclusions and present suggestions for future work.

2 METHODOLOGY

An iterative research process was chosen to inform the direction of the enquiry and shape the collection of useful material. The study consisted of a literature review and a benchmarking study.
The literature review drew on traditional sources such as books, journal articles and conference papers, and due to the evolving nature of the subject matter, web pages, blogs and online discussion forums. Industrial Product Design is a broad and complex profession [10-12] which consequently draws on knowledge from many other disciplines. Therefore, this literature review also took into account practice in Engineering, Science and Technology Studies and Interaction Design.
The benchmarking study aimed to investigate current practice in teaching ethics to design students. A range of institutions identified through the literature were considered: Ohio Northern University (US); University of Illinois at Urbana (US); Virginia Commonwealth University (US); Ohio State University (US) and University of Strathclyde (UK); Loughborough University (UK); Bezalel Academy of Arts and Design (Jerusalem); Imperial College (UK); TU Delft (The Netherlands), The University of Twente (The Netherlands), Technische Universiteit Eindhoven (The Netherlands), and Stanford University (US). Due to the emerging nature of ethics teaching in design and engineering, institutions involved in the benchmarking survey were not selected on a geographical basis (as this would have considerably limited the selection available), instead they were selected on a 'cor look at that' basis [13]. The focus of the data collection was on the type of content taught and the on the methods used to teach the material. Data was collected by reviewing published material about courses from the above institutions, via face-to-face interviews (where possible), via e-mail correspondence and via internet searching. It is recognized that ethics may be taught implicitly, and not necessarily labelled as "ethics", for example in modules teaching ergonomics, safety issues and the ethics of user centered research may be taught [9] and as such not all examples of teaching will have been picked up. The data which was gathered was collated in a Microsoft Word file then two mapping exercises were carried out to group and record the different types of topics covered and record the types of techniques used to teach ethics. An enhanced understanding of important ethical issues in design and potential mechanisms for their teaching emerged.

3 ETHICAL ISSUES FOR DESIGNERS

A wide range of ethics related topics arose from the literature. These have been grouped according to discipline (graphic design, industrial/product design, engineering design and industrial design engineering) and will be discussed in the context of the way that they are taught.

3.1 Graphic design

"Creative for a Cause" [14] is a web-based resource which aims to address the current lack of standards and guidelines to aid the implementation of concepts of social responsibility in Visual Communication education and practice. The website features case studies from several educational

institutions who have integrated social responsibility issues into their curriculum, examples from Ohio Northern University (US); University of Illinois at Urbana (US); Virginia Commonwealth University (US) are considered below.

Graphic Design programme at Ohio Northern University (US)

The syllabus for the Graphic Design programme at Ohio Northern University (US) incorporates projects which attempt to examine social responsibility in design. The "goal for these types of assignments is to get students thinking of themselves as citizens, and taking on values and responsibilities as citizens" and to encourage them "to think about the choices they make, and how their work has an impact beyond visual communications" [15]. An example of the type of project undertaken is illustrated by the 'Take a Stand: Participate by not participating' project. The brief was to develop and present a poster and an activist event, for 'Buy Nothing Day', to persuade family and friends to "switch off shopping and tune back into life for one day" [15]. Through the activity students were encouraged to conduct and analyse the results of a questionnaire to understand their target audience. Then generate a range of campaign ideas before working up a final concept which communicates a persuasive message. Students are encouraged to study persuasive strategies, critical techniques, ethical issues, propaganda, and the roles of media in shaping contemporary values [15]. Teaching support was provided through lectures [15].

The School of Art and Design at the University of Illinois (US)

The School of Art and Design at the University of Illinois run a programme for graphic designers entitled "EDGE: Ethics of a Designer in a Global Economy" [16]. The programme is comprised of five projects. One of which - the 'Digital Identity Supergraphic' is a project which asks students to consider how designers cope with issues of "good" and "bad" design and what that means in a profession of "bottom lines" and "client satisfaction" [16]. Teaching is delivered via a lecture, classroom discussion, and an individual assignment through which the student create a personal code of ethics and then a two or three-dimensional mark/symbol that represents how they view their identity [16]. The project aims to raise awareness about personal and other people's identities, take a deeper look at race, ethnicity, culture, and "otherness".

Virginia Commonwealth University (US)

The Arts faculty of the Virginia Commonwealth University encourage graphic design students to discuss and engage with ethical issues in visual communications [17]. Their course 'Design Rebels: Socially conscious graphic design in theory and practice' provides "an overview of the ethical issues facing those working in the field of graphic design" by focusing on three key areas: Corporations (Clients); Advertising/Marketing (Work); and Designers (You) [17]. The course aims amongst other things, for students to: "become aware of the diverse ways in which graphic design can affect the world [and]…gain an understanding of what options exist for designers interested in working from an ethical perspective." [17]

There is a course pack and material is taught via facilitated discussions, lectures, required readings (such as No Logo by Naomi Klein), guest lectures (including marketing, the media, and community activism) and a final group project [17]. Assessment is via the following mechanisms:

- *Question & Reflection:* where students bring in 3 questions and one observation which relates to the readings for that class.
- *Journal:* students make a weekly journal entry reflecting on their experiences
- *2 Research Papers*
- *20-30 minute group presentation*
- *Project Proposal:* a proposal publication (i.e. brochure, booklet, poster, display, website, etc.) for a community-based design project that takes into account the subjects covered in the class
- *Final Group Project:* students choose a single socially conscious design related project to manifest in the community. [17]

3.2 Communication design

Ohio State University (US) and University of Strathclyde (UK)

Meyer et al [18] set out a vision for an educational course aiming to encourage students to reflect on the consequences of the increasingly pervasive nature of communications technologies. In this paper,

Perry's [19] Scheme of Ethical and Intellectual Development is considered as a suitable foundation for an ethics course for advanced undergraduate or postgraduate engineering students specialising in communications. Perry [19] describes three consecutive levels of ethical thinking. In the first stage, known as 'Duality', "students view the world in black and white, good and bad perspectives". With little or no awareness of the ethical implications of pervasive technology, and as users themselves, they "view their increasingly ubiquitous nature as beneficial and acceptable within society". In the second stage, 'Multiplicity', the students "recognize outside perspectives other than their own and begin to reflect upon these diverse viewpoints". In the third, 'Relativism', the students "recognize that that no one answer exists for conflicts and begin debating their viewpoints using personal values, beliefs and aspirations" [18]. The authors suggest that the transition to 'Relativism' can be facilitated by developing students' analytical and communication skills and enhancing their ability to provide sound evidence and support for their beliefs and proposed solutions [18].
They suggest that teaching ethics to engineers should be grounded in ethical and moral concepts while demonstrating relevance to everyday engineering practice by incorporating practical components [18]. Meyer et al's approach to developing their course is rooted in a problem-based learning approach [18]. They plan to utilise a range of delivery methods including; the use of case studies, electronic discussions (facilitated via a VLE and in-class) and seminar instruction. In terms of assessment, Meyer et al [18] recommend methods that support active learning and engagement such as; self-assessment, written assignments (comprised of a mixture of short answer questions and longer issue-based critical essays), cumulative case-study analysis and a group presentation (to encourage collaboration rather than competition).

3.3 Industrial / Product design

Loughborough University, UK

The Department of Design and Technology at Loughborough University does not currently teach ethics as a stand-alone subject but ethical issues do arise when teaching other discipline-specific subjects. A review of modules taught in Design & Technology revealed that ethical issues have been considered in a range of modules.

- How to conduct themselves whilst collecting empirical data with regards the ethics of observation, complying with ethical guidelines; getting informed consent; signage etc. is taught through 1st year Design Practice, 2nd Year Universal Design and to the Final year Dissertation and design practice projects via lectures and tutorials.
- Corporate social responsibility; Human needs; Fair share of the earth's resources; Fair Trade and associated issues; Designers Responsibility via the 'Manifesto for design'; personal ethics; professional ethics are taught through the 2nd year elective Sustainable Design module via lectures and short group oriented design activities.
- Working with vulnerable users is taught through a 2nd Year elective Universal Design module.
- Students are introduced to the ethical responsibilities of designers through a 2nd Year elective Ergonomics module.

For example, a lecture on Designers Responsibility is delivered as part of the Sustainable Design Module. Within this lecture personal and professional ethics are reflected upon and question as to whether industrial designers need to have a set of ethical principles to work to is raised. The Industrial Designers Society of America's set of ethical principles [14] and the 'First things First' manifesto [15], which was aimed predominately at Graphic Designers, is introduced. Following a one hour lecture the students work in groups of six to engage in a two hour activity where they attempt to develop 'A Design Manifesto for the 21st Century'. They are asked to read the 1964 & 2000 First Things First Manifestos, consider how these relate to product design and what alternate issues they should be considering. They then set about defining the purpose of the manifesto, e.g. to regulate behaviour; to aspire to, to inspire etc. They then brainstorm and prioritise the values that they think are important to product designers. Finally they identify 10 principles for designers to follow i.e. ways that they should be practicing and consider how the code will be implemented. Finally, they present their manifesto orally to the other groups.

Bezalel Academy of Arts and Design, Jerusalem

At the Bezalel Academy of Arts and Design in Jerusalem an elective module on 'Design Ethics' is taught as part of the MDes Industrial Design programme [20]. The course aims to make students aware of the breadth and extent of ethical issues; create an environment for raising difficult design related ethical questions; highlight the concept of "ethical friction" and learn to identify its existence in real life situations; and create a sense of responsibility regarding ethical issues relating to designers' practical work. The course consists of one three hour session each week over the course of one semester. Typically 15-20 students elect to take this module. Students work in teams of 2-4 and the teaching modes used includes: presentations, lectures (including some visiting lecturers) and many discussions.

A range of subjects that create "ethical friction" are covered. These include:

1. Environmental and Social Sustainability.
2. Populations with Special needs – Inclusive vs. Tailor-made design.
3. Intellectual property – copy right, copy left, creative commons and other methods.
4. Design and designers relationship with Consumerism.
5. Safety – user responsibility, user protection versus quality of product experience.
6. Ethics and Manufacturing – designers' effects on methods and environments of manufacture.
7. Global/Local – Design ethics and culture.
8. Participatory Design – Balancing the sharing of knowledge, users as designers, and the design professionals' duties and responsibilities.
9. Design for Security and Military uses
10. Ethics and Aesthetics – philosophy and practice.
11. The ethics of client and service provider relations [16].

3.4 Engineering design

Imperial College (UK);

Imperial College offers an elective course titled 'Controversies & Ethical Dilemmas in Science & Technology' as part of the Humanities programme. Though not designed by the engineering faculty, this course offers engineering students an opportunity to critically analyse their work, and profession, from an ethical perspective. The course equips students to analyze, understand, and construct arguments concerning the ethical and social problems raised by science and technology using ethical theory, knowledge of the relations between science and society, and knowledge of recent historical examples [21]. Specifically it covers: The history of ethics in technology and society (including technology and warfare); Ethics in everyday engineering and research; Controversies arising around science and technology; and Controversies and dilemmas arising through medicine and biotechnology. Students are assessed via two coursework essays and an examination [21].

3.5 Industrial Design Engineering

The 3TU.Centre for Ethics and Technology [22] is a collaboration of the philosophy sections of the three Dutch Universities of Technology: Eindhoven University of Technology (TU/e), Delft University of Technology (TU Delft) and University of Twente. Though education is not its primary aim several of its members are involved in teaching ethics at its member institutions.

Delft University of Technology (TU Delft), The Netherlands

In 2003 a new course on ethics for Industrial Design Engineers was developed at the TU Delft. This course was optional, and tended to attract those students who recognised the importance of considering ethics in design [23]. Instead of teaching ethics as a distinct subject, it focused on "a range of existing subjects in design education from an ethical point of view [including];

- Design Process: How the act of designing might also be considered an ethical act.
- Interaction and the form of use: How products shape our behaviour
- Sustainability: Looking at the arguments for and against sustainable design
- Responsibility: How far the individual is responsible for work that is done for clients or in organisations.
- Marketing: How design can be used, for example, to seduce people into buying things they wouldn't normally buy" [24].

The course consisted of one lecture a week introducing each new subject area plus weekly student exercises provided through a course reader containing relevant articles, book sections and worksheets containing questions about the articles in the reader. The assessment was via 3000 word essay [23].
The students enrolled on this course also take part in an augmented version of the *Delta Design Game* [25]. In multi-disciplinary teams of between 4-6 people, the students go through a complex design process set in a fictional land with slightly different rules to Earth. Their task is to design and construct a building. During the exercise they must consider the implications of external forces such as a "gravity wave" on the integrity of the structure and work together, within their given roles, to develop a feasible solution. The game takes around three hours to play after which there is a short review. At the end of the exercise (in Lloyd and van de Poel's incarnation) the students are given a further scenario – that after several years after construction their building has been destroyed and that the community wants to know who is responsible. The students are given several days to reflect on the exercise and draft a press release. The aim of this exercise is to encourage the students to reflect on the design decisions made during the game. Repeated game-play has highlighted that there is generally little explicit discussion about ethics there is during the game. The gravity wave scenario is explicitly considered by most groups, but there is no sense that the purpose of the game might turn on the ethical seriousness of this scenario becoming true. This, we would argue, is the situation in most design processes. There is usually a vague sense of what could happen without an explicit discussion of how such a possible situation might be avoided. There is also no discussion about how bad it would be for such a situation to occur." [24]. In spite of this, the authors concluded that although "the Delta Design game contrives an ethical situation…it does so in a manner as realistic as possible [and] it has proved effective in communicating and illustrating the ethical concept of responsibility" [24]. "Playing a design game helps students to reflect on the consequences of their own actions rather than the actions of others as is traditionally taught with case studies" [24].
A further course of interest to this project, currently taught on the Design for Interaction Masters programme at TU Delft, is "Reflecting on Designing" [26]. The objective of this course is to "contribute to the development of critical, conscious and authentic design philosophy and design attitude" [26]. Students are given a series of lectures from external practitioners from a range of disciplines who talk about ethical, philosophical and societal aspects of design, from their own personal perspectives. Following the lecture series, the students are asked to reflect on their own personal vision for design by attempting to answer the following prompt questions:

- "What are your values, goals and dreams?
- What is your role in society, what are your responsibilities towards people?
- Do you have a method, do you need one?
- What inspires you, how do you keep inspired?
- How are these ideas reflected in your design projects?" [20]

The students reflections can take a variety of forms including (but not restricted to); a movie, written essay (with images), computer presentations or even jigsaw puzzles, gift wraps, games and animations. The students take very different approaches to the task often developing distinctive tools and techniques. One student reportedly "created two collections of products: products she really would have loved to design and…products that she would be ashamed of if they were her design. Next she analysed these collections on emerging themes and on the visions underlying these designs. This analysis allowed her to create her vision…" [26].

University of Twente, The Netherlands

The University of Twente, coordinates a masters program in 'Philosophy of Science, Technology and Society' in conjunction with the philosophy section of Delft University of Technology. One of the masters' tracks, 'Philosophy of Technology and Science' offers two relevant modules as part of the curriculum; **'Ethics and Technology I'** aims to introduce students to the major ethical theories and some key thinkers in moral philosophy and includes a short introduction to the role of ethics engineering practices [27]. Skills of moral analysis and judgment are trained throughout the course with the aid of the interactive AGORA-program - "a software environment for case analysis in the domain of ethics and technology"[28]. **'Ethics and Technology II'** focuses on the question of technology, recognizing that in our society technology is everywhere as such a pervasive force it calls for moral reflection. Both are taught via seminars and workshops and assessed via written exam and assignments.

Technische Universiteit Eindhoven (TU/e), The Netherlands

TU/e offers a module in 'Ethics in Design' on its Industrial Design masters programme where they explore the connection between ethics and design. The main method of learning is through the design and analysis of interactive products, based on different ethical systems, supported by articles to read. It responds to questions such as 'Why do people of different eras and regions value different things?' and asks whether this is just coincidental fashion or where there something deeper that underlies these differences. In recognition of the fact that "what we find beautiful is linked to a set of values we all have, and to the way we think things should be" [29].

3.6 Other

The final example comes from Berdichevsky and Neuenschwander [3] who annually challenge students at Stanford University to design persuasive technologies with troubling ethical implications as a means to explore ethical issues in persuasive technology in a compelling way. On example of the type of output which emerged from this exercise is "My Secret Pal", an interactive doll or toy which tells children its secrets in recognition of the fact that they will naturally reciprocate. Parents can then search a record of their child's secrets and adjust their parenting strategy based on this new information [3].

3.7 Summary

To summarise the findings of this section, a mapping exercise (see Figure 1) was carried out to group and record the different types of topics covered - both to qualify the importance of particular subject-matter and to identify potential gaps in material currently delivered.

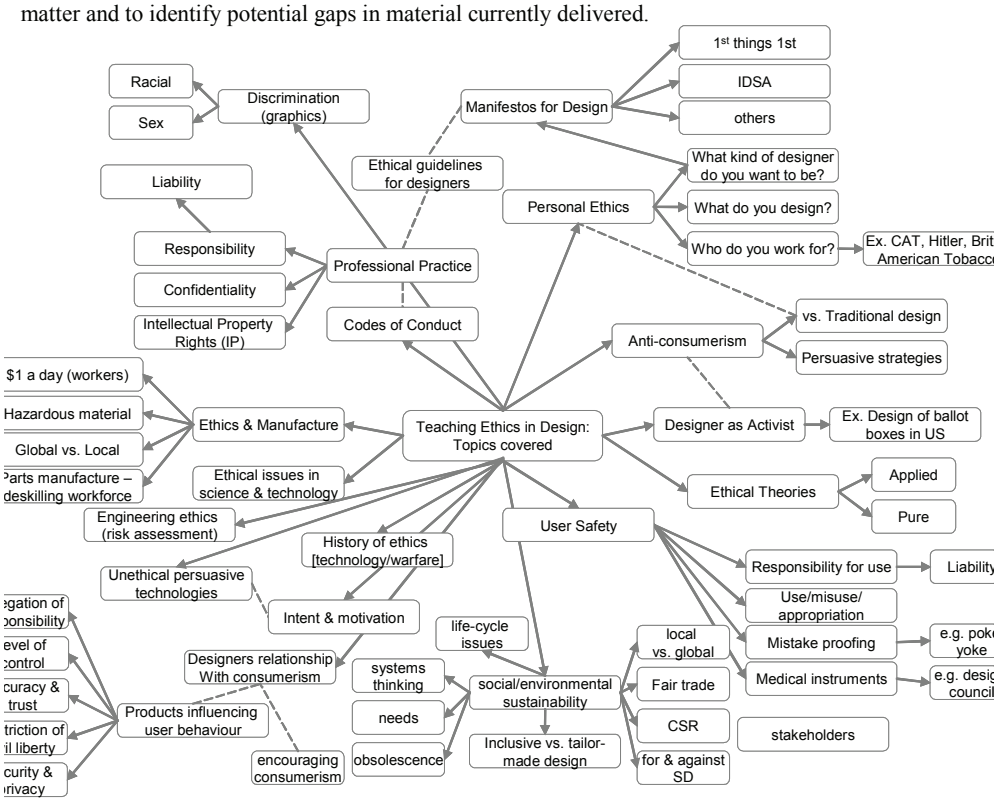

Figure 1 Topics covered in ethics teaching

It showed that few courses in the UK explicitly teach ethics to design students. Indeed, programmes taught in the Netherlands, particularly those with a Science and Technology Studies or Philosophy of Technology focus, appear to be leading the field in delivering educational programmes and modules which examine ethics and technology. Few courses, with the exception of Stanford (where the study of

'Captology' or Persuasive Technology originated) have explicitly ethical integrated issues relating to the design of products with the intent to influence user behaviour into their curriculum.

4 EVALUATION OF POTENTIAL TECHNIQUES FOR TEACHING ETHICS TO DESIGN STUDENTS

This section looks beyond the teaching of ethics, identified through the benchmarked Universities to reflect on other pedagogic literature which highlights additional potentially useful techniques for teaching ethics to design students.

4.1 Role-Play or Structured Controversies

Role-playing is recognised by as being a useful way of teaching ethics [4, 8]. It is "an active learning technique in which students assume the roles of participants in a case "in order to understand their motivations, interests, and responsibilities" [30]. One type of role-play is the "structured controversy" in which students "assume the identify of the stakeholders brought together to debate an issue which is, by definition, controversial" [4]. The lecturer facilitates the exercise and directs the activity towards meeting a specific teaching goal. A typical structured controversy concerns a proposed development in an environmentally sensitive region. The students are not explicitly made aware of the ethical dimension of the workshop, nor do they receive any lectures prior to the workshop [4].

Students are divided into groups and assigned the 'persona' of one of the four main stakeholders involved in the debate (the developer, the nature advocate, the consulting engineer or the regional council officer). Each stakeholder group is provided with background information on the proposed development. Information particular to the stakeholder each group is assuming is also provided. The additional information reflects the viewpoint of the stakeholder in question and often conflicts with information given to other stakeholders. The groups are given 20-30 minutes to prepare an outline argument and counter arguments prior to the fictitious public meeting which follows. An elected spokesperson from each group is chosen to represent their interests at the public meeting. To encourage active participation, the remaining group members can provide counter-arguments to assist their representative by passing them a written note. Typically the debate lasts for 20-30 minutes before reaching an impasse. At this point, the lecturer should step-in, congratulate the players for their involvement and wrap up.

Engineering teaching generally takes a deductive approach (i.e. a concept is introduced first and followed by a specific example) however, "students learn best when their knowledge is anchored in concrete examples"[31]. By arranging the lectures *after* the structured controversy workshop the students are able to connect the arguments posited by the stakeholders with the ethical theories or standpoints described in the introductory ethics lectures which follow.

4.2 Case Studies

In engineering, ethics is generally taught through a lecture-based course which draws on "case-studies of ethical decision-making in engineering to illustrate theory"[32]. The HEA Engineering Subject Centre in conjunction with the Inter-Disciplinary Ethics Applied Centre for Excellence in Teaching and Learning (IDEA~CETL) and the Engineering Centre for Excellence in Teaching and Learning (engCETL) have developed a series of case studies to support academics delivering ethics teaching to engineers. These 'off-the-shelf' case studies are based on real-life ethical scenarios drawn from industry. The resource includes; student/ tutor notes, bibliographies, reading lists and teaching guides.

Case studies are seen as "an extremely effective tool for embedding ethics within an existing curriculum: by getting students to engage with scenarios that they are likely to encounter as professional engineers they are forced to confront and question their own opinions, and justify their actions"[8]. Meyer et al [18] agree that case studies "present realistic everyday ethical issues for reflection…connect…fundamental principles learned in the classroom to real-world engineering practice". Lloyd and van de Poel [24] however, argue that "the chronological 'neat' way that evidence is presented" in a case study can "give the impression that, with all the evidence laid out, making a decision on an ethical basis can be relatively easy. The implication here is that the actual ethical problem is located, not so much in a choice situation, but in the 'messiness' of social reality, in the 'smaller' ethical decisions that the process of design throws up…. [and that] by cleaning up this messy reality, case study analysis can remove the very element of uncertainty that characterises unfolding

ethical situations" (p.660). "Designers have to take into account the many-sidedness of reality" which means "taking to account the full complexity of the situation" [5].

DeVries [5] raises a further point, noting that 'classical' cases presented to engineers in ethics textbooks, such as the Challenger space shuttle, tend to analyse all ethical issues in terms of moral dilemmas taking a reductionist perspective. The Challenger space shuttle exploded minutes after it launched, malfunctioning 'O rings' were widely believed to be the cause. Engineers working in the company who delivered the 'O rings' were aware of the associated risks in using the devices and had expressed their concerns to their superiors, but were over-ruled for fear that relaying this information would not only damage the companies reputation but also delay the launch. DeVries argues that textbooks cases such as this "reduce the ethical analysis to choosing between two alternatives". In this case; stay loyal to the company and say nothing, or take responsibility for the safety of the astronauts and speak up [5]. According to Lynch and Kline [33] in [18] in order to be effective, case studies should emphasise the complexity and ambiguity of technology and its use, rather than provide a clearly outlined conflict of values.
Taking a reductionist view can be useful in as it enables the student to "abstain from other aspects" and therefore "be more precise about the aspect in question". However, to appreciate the complexity of design decision-making they must be encouraged to consider "the full reality of the situation after having studied the aspect of focus" [5].

4.3 Scenarios

Scenarios of use can be particularly useful in enabling designers to imagine and think through the potential effects resulting from the use of the products they design. 'Sustainable Everyday' [34], for example, presents scenarios and solutions showing different visions and ideas of more sustainable everyday living. Example scenarios include:

- *The Food Atelier* - a local multi-service centre combines aspects of a corner shop with those of a neighbourhood restaurant such as "fresh food of the day", "food tasting group", "kitchen club".
- *The Connectivity Club* - based on a small neighbourhood library that provides workstations and distant working facilities such as "neighbourhood office", "local tele-office", "participation board"

Other practitioners also uses scenarios or 'vignettes' to visualise new ways of behaviour and create 'Design-Oriented Scenarios for Eco-Innovation' [35].

4.4 Systems Thinking

Though not explicitly used to teach ethics, 'Systems Thinking' could be a useful method for encouraging students to consider the social and environmental impacts of product use. In contrast to traditional modes of analysis which tend to separate out issues for consideration, systems thinking "focuses on how the thing being studied interacts with the other constituents of the system" [36]. The fundamental premise of systems thinking is that "everything interacts with (affects and is affected by) the things around it" [37]. The benefit of this type of approach is that it avoids the activity of breaking things down into smaller and smaller components, and the consequential loss of the interactions between them [37]. This helps to address some of the concerns surrounding traditional case studies.

4.5 Group Discussion

Group discussion is a valid mechanism for teaching ethics in design [38]. The Online Ethics Center recommend a group discussion activity entitled 'Controlling Technology in the Face of Uncertainty', to explore the extent to which technology can be directed and controlled. Students discuss and debate a range of questions such as: What are the positive and negative influences these products have had? What, if anything, can engineers have done to reduce the negative influences? Is it the engineer's responsibility to try to reduce these negative influences? What can we learn from these past experiences that can be applied to current engineering projects? These debates encourage the students to begin to raise issues which can be explored in greater depth as the course unfolds [33].

4.6 Summary

A mapping exercise was carried out to record the techniques identified through the benchmarking activity and the literature. The results of this are illustrated in Figure 2 which demonstrates a wide variety of interesting techniques which have the potential to successfully teach ethics to designers.

This portfolio of approaches will form a very useful basis for the development of future course material and ensure that a challenging and rich teaching experience is provided to the students.

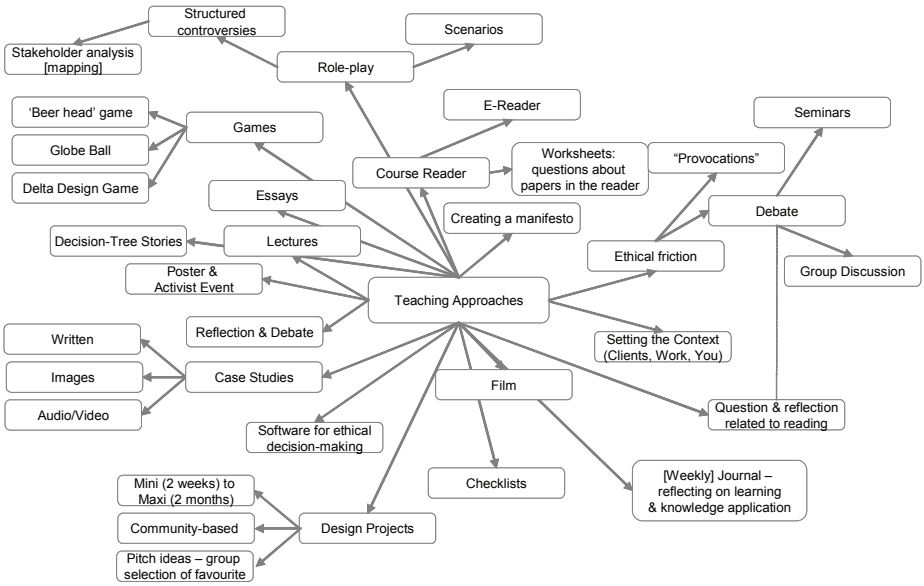

Figure 2 Techniques used to teach ethics

5 CONCLUSIONS

The benchmarking study has demonstrated that there are a broad range of ethical issues relating to industrial/product design practice, Figure 1, and that ethics can be and is taught to designers using a wide variety of techniques and methods, Figure 2. It has been seen that ethics can be taught as either a stand-alone module or integrated within the program curriculum. The difficulty of delivering it as a stand-alone module is that students may perceive it as a separate concern and may fail to apply ethical reasoning in practice. Indeed, debate at a recent Royal Academy of Engineering conference in the UK, confirms that an integrated approach to teaching ethics is preferential [39]. Despite this concern, for the pilot study within this project, the team has created a stand alone module in order to test the suitability of the tools and techniques identified, and to trial the appropriateness of the educational content. However, as it will be embedded in a design project, the ethics component will not be treated as a stand alone concern but dealt with alongside all the attributes of the design process.

The overall aim of this pilot study will be to encourage students to question the role of the industrial designer in promoting and facilitating changes in society, reflect on the ethical aspects of new products, services or technologies aiming to influence user behavior; consider the moral acceptability of their application and evaluate how they may influence the environment and society positively or negatively.

The pilot study will target a small group of five postgraduate Industrial Design students (all International/non-UK) studying Sustainability and Design over a four week period. With this audience in mind, the time constraints, and the available teaching environment the team drew from the techniques collated during the benchmarking study to generate a program of delivery. This will comprise of a series of lectures with embedded activities, which feed into an individual design project. Embedded activities will include: Games – (e.g. Globe ball) to highlight personal impact; audiovisual cases studies to promote discussion around specific ethical issues for designers (e.g. Caterpillar – designer's responsibility for the impacts of use); stakeholder analysis; reflection and debate (e.g. provocative questions and ethical analysis). Throughout the project, students will keep a project log book (similar to a journal) to record their progress encouraging a shift from surface learning to deep learning through use of reflection. Supporting resources will be uploaded in to the e-learning

environment to allow students to review the material at their own pace and allow deeper reflection on the issues presented.

This pilot will be run in April 2009, analysis of the outputs will inform a future aim, to expand the pilot to develop module material for a large undergraduate program. Further investigation into how these techniques could be adapted for delivery via e-learning will also be undertaken.

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