

# “What Do We Do Now?” Teaching Sustainability in IT

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## Abstract

This paper describes the integration of Computing for Sustainability into two first year courses in a vocational Information Technology degree. The first approach is was an assignment to create a “green computing” poster. The second is an attempt at promoting deeper learning through reflection on the relevance of a film or novel. Each assignment is presented as a reflection on teaching practice from one of the two authors.

## 1 Introduction

From trepanning to vitamin pills, from the stone axes to nuclear fission, human beings have demonstrated unparalleled skill at technological invention coupled with an equally unparalleled lack of foresight. “*What do we do now?*” *Teaching Sustainability in IT*” grew out of two class assignments in the Bachelor’s Degree in IT at Otago Polytechnic—one in Fundamentals of IT and the other in Communications. This paper is intended as a contribution to the sharing of practices for integration of Computing for Sustainability (Mann and Smith 2007a,b) and contributes to the NACCQ policy and agenda for Computing Education for Sustainability (Mann 2007).

The title, “What Do We do Now,” reflects both a) our contemporary, Western practices of using technology first, then recognizing its impact on our world in retrospect; and b) our current and critical need to identify solutions to the problems we have created in ways that can be acted upon by each of us, immediately. Based on the cultural myth that IT professionals think only of their bits and bytes, these assignments were created to push the students outside the stereotype by examining other contexts to gain information and insights about human beings, their attitudes, behaviours, and interactions vis-à-vis their environment and technology (especially, information technology.) Within the parameters of these assignments, “sustainability” was defined as preserving and maintaining for future generations, a planet which can continue to provide the abundance and diversity of resources necessary for life, human and non-human, to thrive.

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In the Fundamentals of IT class, the students were given the five questions used in news reporting—what, who, when, where, and why—together the question “how.” They were directed to answer these questions in a graphic-design format by creating a poster which provides clear and immediate steps that one single person can take to address a specific issue re: IT and the global environment.

The BIT Communications assignment required the students to view a film or read a novel from selected lists, and to interpret it in order to identify issues deriving from the interrelationship between human beings, technology/IT, and the environment. Their interpretation should identify the solutions proposed by the film/novel and the consequences of inaction. To finalize the assignment, they were required to consider both the solutions and the consequences of inaction, and recommend actions that an individual in the real world of “here and now” could take to contribute to the sustainability both of humans as a species and of our environment.

This presentation shares the results of these two assignments--what our students did and what we learned. Each assignment is presented as a reflection on teaching practice from one of the two authors, before the learnings are integrated in the final section.

## 2 Fundamentals of IT

When I first learned that all papers delivered at OP in 2008 were supposed to include some aspect of sustainability, I did the obvious thing – I googled it – not because I didn’t know what it meant, but because I wanted to see what everyone else was doing. I personally come from a background of Scouting in the USA where “leave no trace” camping is an integral part of the program. I also am the product of parents who grew up in the depression and passed on a philosophy of “use it up”, “wear it out”, “make it last”. I’ll admit that I’ve been a skeptic about the whole aspect of global warming and the political fear-mongering that surrounds it, but I believe in conserving our resources and leaving the world a better place for our children.

So, I googled "sustainable IT".

### 2.1 Getting focused

I wasn’t too surprised when I came up with over 3 million hits. After reading a few articles, I decided I needed to

focus my search more to get something I could use in my Fundamentals of IT class. I thought about NZ and the concept of being environmentally conscious described as “green” and decided I would combine a search for green and computing at the same time. (I thought I was being pretty clever.) Google still returned over 1 million hits for this pair of words. I decided that was better and read and read and read. There are many blogs on this topic – evidence of the volume of interest in green computing. It didn’t take me too long to find Greenbiz.com and to subscribe to a RSS feed from them. However, even these efforts seemed to have a focus on the corporate IT department and especially data centres. I needed to come up with something applicable to my students that would inform and involve them in sustainability – and still be fun.

I thought about having them write an essay, but they were already doing that for another aspect of the course. Likewise, I discarded creating a web site because I already had other plans for that exercise. I’ve long been impressed with some of the posters around the polytechnic that have the theme: “spot the computer”, so I thought I might do something along those lines. The poster idea began to gel. Next, I needed to give it some academic rigor.

I discussed this with my wife, who teaches communications, and she suggested the students attempt to answer the five journalistic questions of: what, who, when, where, and why in their posters. I wanted the students to research the issues in the area of green computing, but I also wanted them to see that there were things they could do personally and professionally. I decided they needed to present the environmental problems, consequences, possible solutions, and methods for achieving those solutions. Quite a big ask for a single poster. I also have a stream of Design students taking the Fundamentals of IT class, so I thought this might appeal to them and give them a chance to excel in what for many have been new areas of education.

## 2.2 The assignment

Finally, I transformed these thoughts into an assignment as shown in Table 1.

Lectures and labs in the week preceding the due date were on green computing concepts. I provided targeted readings in their textbooks and links to websites and articles I’d discovered in my own browsing and from my RSS feeds.

**Table 1: Fundamentals Assignment**

**Purpose:**

- To explore the sustainability issues within the IT field
- To examine the social impacts of this area
- To demonstrate the skilful use of application software

**Content:**

Using your text and other sources of information for your information, create a poster dealing with any aspect of green computing.

Your poster should answer the five journalism questions of:

What Where When Why Who

It should also be arresting, or eye catching, and interesting in a marketing sense. It should get our attention, inform us of the issues, and tell us what we should do (how to respond).

**Format:**

Your poster should:

- Be printed in colour on A4 paper
- Apply the principles of presentation (eg. use of white space, colour, fonts, etc.)
- Include a citation of your sources of information on the back (this may be handwritten if you like)
- Include a black and white copy on which you have circled items that answer the five journalism questions and the “how” item. Label them appropriately.

### 3.1 Student performance

Results were mixed, but even the less able students did an admirable job of getting the concepts onto paper. Figure 1 shows two samples of the work from those who were willing to share them publicly.

### 3.2 Student feedback

To complete the research for this paper, I needed to find out if the assignment had been an effective way to raise my students’ awareness concerning environmental sustainability and the issues surrounding computing. I decided to use an open-ended questionnaire in order to elicit what I believed would be the most complete responses. The use of class time and the classroom space inevitably influenced the students’ responses; however, I attempted to minimize this influence by deliberately framing the questionnaire as a request for their help in order to present the findings to other IT teachers.

The questionnaire (see Appendix) contained ten questions and the students were ask to respond in their own words. What is interesting to me, as a teacher and professional in the IT industry, are the scope of their answers and the mindset that these reveal.



Figure 1: Sample student Green Computing posters

### 3.3 Feedback results

Question 1 asks the students to describe the poster assignment in terms of its effectiveness in raising their awareness of “green computing. 19 out of 20 of the students stated that the assignment had been effective—even “very effective”—in raising their own awareness of the need to approach their industry from a “green” perspective. Most said they wouldn’t have learned what they did on their own, but because it was an assignment, they were far more aware than before. Will their behaviours become greener? Their responses to question 3 suggest that, because they overwhelmingly tie awareness to behaviour change, they, themselves, will probably make some changes in their own behaviours.

Several of the most interesting—and I believe significant—concepts that their responses suggest is that

- we as individuals *can* make a difference, especially regarding energy savings and recycling,
- that government intervention should be in the role of a support agency rather than as a regulatory or punitive one, and
- that manufacturers bear responsibility for their products, particularly in creating incentives to recycle and in building products (hard and soft) which do not have obsolescence—or upgrades—built in.

The students also revealed a surprising grasp of the conflict between the needs of a profit-driven economic model and those of environmental sustainability. Their primary response to what the individual who uses a computer can do was dominated by two actions: “turn it off,” and “recycle it.” (Their recommendation for use of power saver options further suggests a possible manufacturer/supplier role in setting power saver options as the default setting.) Finally, their responses reveal that while they appear to believe that awareness of the environmental need will prompt action, they also reflect an overwhelming belief that it will take economic incentives (cash, awareness of savings to the power bill, etc.) to truly motivate the general population to “compute” in more environmentally responsible fashion. (One student’s responded as follows: “Don’t upgrade your computer, ever. In fact, don’t use it at all. The power saving feature is called ‘off.’” While I recognize the simplicity in this advice, I hope everyone doesn’t take it. We’ll all be out of jobs!)

### 3 BIT Communications 101: Images, Ideology, and IT

My educational background is in literature and critical theory; my teaching experience is diverse: 36 years in university or polytechnic teaching, in the fields of literature, media studies, and communications (including journalism, business and IT). I have also worked as a programme manager in the Finance Division of a Fortune 500 company.

When I joined the IT dept. at Otago Polytechnic this year and learned that the communications was the only course for which no sustainability component had been submitted, I responded with an assignment which I believed would challenge my BIT students to “see” the cultural dialogue surrounding technology, the environment and human survival by engaging with image and narrative in the form of novels or films. Why? First, it is in our communication, both through images and narratives, that beliefs, attitudes, behaviours and values are expressed, critiqued, and passed on. Our social, political, and cultural ideologies are both transferred and challenged by our stories and our images. Second, it is because books and films are “hot” media—that is, they are participatory media requiring active engagement in order for the receiver to intake their content; thus, they often elicit a more profound response than “cool” or passive media (Vivian 2002).

In our Western cultural narratives, we can identify a repeating pattern—a motif—of cultural anxiety concerning what our creations can do to us. From Icarus’ fatal flight to the earth’s revenge against humanity in the Biblical Flood, from the Trojan Horse to the Terminator, from Shakespeare’s Prospero to Mary Shelley’s *Frankenstein*, from the novels of Thomas Hardy to *The Matrix*, from Ovid’s Pygmalion who falls in love with his own creation to Bryan Singer’s Katie Fuller who falls in love with her own computer simulation—our stories betray us: we *know* that we can destroy ourselves through

what we make and what we do. Further, our recent stories—books and films—have been warning us, specifically, about the worsening environmental crisis for over 50 years. As early as 1962, Rachel Carson's *Silent Spring* predicted dire consequences for our behaviours towards the environment; in 1970, the British film *No Blade of Grass* (based on the 1956 novel, *Death of Grass* by Samuel Youd) depicted world-wide famine and a resultant global plunge into chaos due to environmental pollution; in 1982, Godfrey Reggio's *Koyaanisqatsi* (*Life out of Balance*) bombarded the viewer with visual images of what we are doing to our world. Today, Al Gore's *An Inconvenient Truth* reprises images and warnings from half a century ago, and challenges us to do something now, because we have no more tomorrows.

### 3.1 Teaching the fish to see the water

Paolo Friere (1970, 1993, 1994: 26) tells us, as teachers and as human beings, to be involved in the “vocation of becoming more fully human.” I believe, in order to become “human,” it is essential that students be empowered to take control of their own lives and minds. A vital aspect of this process is their learning to take control of the of the media products they encounter—to learn to understand and interpret the “imaginary.” Nichols (1981: 3) defines this term, “imaginary,” to mean not the “unreal” but the “views, images, fictions, or representations that contribute to our sense of who we are and to our everyday engagement with the world around us.

These images are the signs of social representation, the markers or bearers of ideology...” In this view, Nichols echoes Taine's critical theories that define the artist in terms of “race, milieu, and moment”: that the creator/artist is the product of his/her nation, generally, his/her own cultural climate and circumstances, specifically, and his/her own location in time, i.e. the *Zeitgeist*—of the age. Art—including film art and literature—then, is a social, historical, and cultural product. Nichols also reminds us that “language, if considered semiotically, includes all forms of communication based upon signs . . . words, clothes, gestures [and is a] necessary element of all material social practice.” (1981: 2) Thus, in order to effect change in ourselves and in our world, we must be able to comprehend the meanings of the signs—the images and language—with which we are confronted. Finally, cultures—their images and ideologies—change, their paradigms shifted by the intersection of Taine's “race, milieu, et moment”: the right person, the right surroundings, and the right time.

### 3.2 The task at hand

The BIT Communications 101 students' assignment required the students to view a film or read a novel from selected lists, and to interpret it in order to identify issues deriving from the interrelationship between human beings and each other, our technology (esp. IT), and our environment. Their interpretation should identify the underlying problems caused by technology, any benefits

to be derived from technology, the relationship of human beings to each other and to their societies, vis-à-vis technology, and any solutions proposed by the film/novel. Finally, they were asked to identify the consequences of inaction. To finalize the assignment, they were required to consider both the solutions and the consequences of inaction, and recommend actions that an individual in the real world of “here and now” could take to contribute to the sustainability both of humans as a species and of our environment. Their interpretations and recommendations would be submitted as an oral panel presentation supported by written documentation and, when using a film, visual examples. (See Appendix 1: Oral Communications Assignment Overview.)

### 3.3 How we went about it

I spent 3 weeks “gearing up” for the presentations by first, equipping the students with a few critical tools and second, equipping them with presentation skills. The critical theory material they received was selected to give them the vocabulary to enter into a critical dialogue. We began with “ekstasis”—the gut-level reaction to any media product—and moved to the basics of historical, psychological, archetypal / mythological, and semiotic theories so that students could have a vocabulary and a sense of perspective that would facilitate interpretation and discussion. Then, I provided them with some foundational information regarding the psychological and cultural ramifications of selected visual elements: relative position, proportion, basic colour theory, darkness, shadow, and light. We viewed and discussed selected paintings, including traditional landscapes, the Mona Lisa, Breughel's “Landscape with the Fall of Icarus,” and several selections by Grahame Sydney. The purpose of this discussion was to help the students to see how art—the “imaginary”—can be interpreted in terms of how it reflects our values vis-à-vis the relationship between the human being and the environment.

I also presented them with the rudiments of film criticism so that knew what to call a shot or a technique. Their preparation as media critics was not exhaustive; rather, the purpose was give them the equivalent of a hammer and pry bar so they could start to break into the meaning of images they were viewing. We then spent one lab session viewing Bryan Singer's *X-Men*. The following lab session was spent discussing the film using the information from the lectures. In the final weeks of preparation, I presented oral presentation skills and furnished lab time for practice.

### 3.4 The results

Prior to their beginning their own film analysis, we had class discussion which focused on *X-Men*—a film we'd viewed in the last lab session of the preceeding week. Before we started the film, the students were asked to answer the question: “What did you see, and what does it mean?” The students were also directed to note costumes, use of colours, and characters' names and special powers. This discussion provided some interesting insights relating visual images to plausible

interpretations. In discussion, one student pointed out that most of the mutants' powers related to natural elements or forces and that the "evil" mutants tended to use their natural powers to the detriment of human beings, while the "good" mutants used theirs constructively or protectively. Further, we discussed the binary division of Us/Them between the human characters and the mutants. Another student also asked if anyone else noticed that the mutants in the film "were sort of like the gods and goddesses" of ancient mythologies. Pursuing this line of thought, we discussed our traditional Western view of nature as something *outside* the human being—something that we can use or control, but also something that is threatening and dangerous. Perhaps the best observation of all was centered on the character Wolverine as the impersonation of our attitudes and behaviours towards our environment. He is immensely powerful—can even heal himself—yet he is the victim of human tampering which changed him in an unalterable and fundamental way. His power is unpredictable, and the outcomes of its use are far from assured.

Further research on this project will include a survey of students' learnings and reactions, as well as an assessment of their own presentations, with their recommendations of what we *can* do now.

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## 4 Appendices

### 6.1 Technology Fundamentals Survey Response Analysis

1. *What do you think of our poster approach to increasing your awareness of sustainability issues in IT?*

17 out of 19 responded that the assignment was effective in raising their own awareness of environmental sustainability and computing. Three students noted the poster as having an advantage re: advertising the issues to a broader audience and one student stated that it was more effective than an essay, while one student noted the limitations of the poster medium, i.e., that only a few of many important issues could be presented.

2. *What should be our vision, as IT professionals, of sustainable computing?*

While the broader definition of "vision" was not addressed, 19 students noted the "concerns" related to their chosen field: recycling, being aware of sustainability in computing, need for manufacturers to create products with longer life cycles and more environmentally friendly designs. One student noted that sustainable computing needs to become something "you want to do."

3. *How can we encourage more public involvement in action to reduce the environmental impact of computing?*

Of 19 responses, 14 students emphasized awareness and education, one of these also contained the pessimistic observation that people have been informed for years about environmental issues and still have done nothing. Three noted the need for incentives; one student said that people need to be "forced" into sustainability practices, while one student mentioned a specific small step—no "preview" printing for documents.

4. *What areas of computing do you think need to be tackled first? Why? What actions need to be taken by whom?*

Thirteen students—the overwhelming majority—mentioned recycling as either their entire response or as a component of their response. Eight students responded—either as a component or as their entire response—that manufacturers need to take responsibility for the sustainability of their products; four students noted that the government needed to be involved in stimulating recycling. One student also noted the manufacturer's conflict of interest re: profit and the environment.

5. *What are the main barriers to action on IT environmental issues?*

Six students responded that awareness is the main issue; money/expense was cited four times; the "hassle" of taking action was mentioned twice, and one student citing lack of interest on the part of the computer user. One student noted that the manufacturers "can't take care about [sic] the profit and environment [sic] at the same time," while another student stated that "there are bigger issues like world hunger, war, and the depression that everyone's [sic] predicting."

6. *How can communication and raising awareness support greener computing?*

All responses cited communicating and raising awareness will prompt action re: computing and sustainable behaviours. Two of these responses included cost of sustainable behaviours as possible deterrents.

7. *What is the single MOST important thing an individual can do to advance sustainable computing?*

Thirteen responses included some reference to recycling; seven responses stated that communication of the problem was the most important; one student responded that the manufacturers should improve technology and lower costs. One student stated “Don’t get a computer.”

8. *What do you think it would take to get the average person to stop sending old and broken computing equipment to the tip?*

14 students responded that some form of monetary incentive would be necessary. Two students responded that more information/awareness was necessary, while another suggested—somewhat problematically: “Close the tip, that way they’ll dump it somewhere else.”

9. *What do you think it would take to get the average person to use power-saving features of computers and to turn them off when they will not be used?*

Nine students responded that it would take a monetary incentive (cash payments, product rebates, or amounts saved on power bills), while three stated that power-saving options need to be either pre-set or better advertised. One student responded that manufacturers need to build equipment that is more power-efficient.

10. *Name one small change you think almost anyone could incorporate into their life, in the direction of greater sustainability.*

Of 20 responses, 17 stated using power-saver features and/or turning the computer off. (In fact, of the 17, 11 cited “turn it off” as the first choice.) One student cited recycling your old computer and tied it to “telling someone about what you did.” One student recommended planting a tree, while one wrote “Don’t upgrade your computer, ever. In fact, don’t use it at all. The power saving feature is called “off.”

## 6.2 Communications Assignment Overview: Sustainability and Communications in IT

### “What Do We Do Now?”

**Rationale:** This assignment asks BIT yr.1 communications students to confront the issue of sustainability by asking the question “What do we do now?” The assignment title reflects both a) our contemporary, Western practices of using technology first, then recognizing its impact on our world in retrospect; and b) our current and critical need to identify

solutions to the problems we have created in ways that can be acted upon by each of us, immediately.

**Definitions:** Within the parameters of this assignment, “sustainability” will be defined as preserving and maintaining for future generations, a planet which can continue to provide the abundance and diversity of resources necessary for life, human and non-human, to thrive.

**Learning Outcome:** Students will use works of popular media—text and film—in order to identify images which betray our lack of awareness of the impact of our technology has on our environment and on us. These images portray or imply potential consequences of this lack of awareness, as well as portray or imply the sources we have traditionally relied upon for remedies.

From this recognition, the students will then go one step further: to identify our past methods of development and implementation of new technologies and the drivers (economic, social, political, and cultural) which provided the impetus to this development/implementation. They will also consider our current approaches to addressing the impact of those new technologies. From this, they will develop insights into new and different approaches to solving the problem of sustaining our existence as a viable species on our planet. (Hopefully, one of the responses will include amending our process of development and implementation of new technologies to include a serious consideration of the *potential* wider impact of our actions, and to factor in this wider impact in our decision-making. In short, developing new technologies with foresight rather than reacting to their effects in hindsight.)

### **BIT Curriculum Elements/Performance Outcomes:**

This assignment contributes to satisfying the following BIT curriculum elements/performance criteria: 1-4, 6-9. It takes the specific parameters of IT communications one step further, however, by raising the students’ awareness of the impact of both visual and narrative imagery—elements that are ubiquitous in our human communications behaviours. Finally, it contributes to developing the students’ abilities as critical thinkers and provides an opportunity for them to consider themselves, their culture, and their discipline in a wider context.

**Methodology:** Students will be required to work in teams which will be organized in to attempt to ensure as much diversity (age, gender, culture, etc.) as possible. The teams will select one novel or one film from the following list and analyze it from the perspective of human and environmental sustainability vis-à-vis technology, esp. IT, with a focus on such issues as genetic modification, environmental pollution, human and environmental exploitation, cloning, etc.

They will then present their analysis and recommendations in a formal oral panel presentation with Q&A. The format will be as follows: 10-15 minutes for novel presentations, 15-20 minutes for film presentations which have a 3-5 minute maximum for film excerpts. Presentations will be supported with PowerPoint slides,

film excerpts, quotations, and other pertinent research. Students will submit a documentation portfolio and written presentation summary to the instructor prior to their presentation.

**Resources to be used:**

**Novels:**

Isaac Asimov

*I, Robot*—

*Shelters of Stone*—Jean Auel

*Angels and Demons*—Dan Brown

*Cell*—Michael Crichton

*State of Fear*—Michael Crichton

*Next*—Michael Crichton

*The Swarm*—Michael Crichton

*Brave New World*—Aldous Huxley

*1984*—George Orwell

*Frankenstein*—Mary Shelley

*The Time Machine*—H.G. Wells

**Films:**

*2001, A Space Odyssey* (1968) Kubrick

*I, Robot* (2004) Proyas

*The Matrix* (1999) Wachowski

*The Time Machine* (2002) Wells

*Robots* (2005) Wedge/Saldanha

*Superman Returns* (2006) Singer

*Them* (1954) Douglas

*Princess Monoke* (1997) Miyzaka

*Lord of the Rings Trilogy* (2001-3)

*The Gojira (Godzilla)* (1954) Honda

*Jurassic Park* (1993) Spielberg

*Children of Men* (2006) Cuarón

*The Island* (2005) Bay

*Silent Running* (1972) Trumbull

*Mad Max: Beyond Thunderdome* (1985)

Miller/Ogilvie

*Gattaca* (1997) Niccol

*The Boys from Brazil* (1978) Schaffner

*Fight Club* (1999) Fincher

*The 13<sup>th</sup> Floor* (1999) Rusnak

Note: Student proposals for additions to the viewing/reading lists, or modifications in the methodology will be considered, if justifiable.