Paper for International Journal of Sustainability in Higher Education

Household ecological footprinting for active distance learning and challenge of personal lifestyles

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Words: 3,992 IJSHECromptonRoyCairdD4.doc 12.11.01

Biographical Notes

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Dr Sally Crompton is a Technology Staff Tutor and Sub Dean External Relations with a background in environmental technology and networked collaborative learning. She contributed to *Working with our Environment: Technology for a Sustainable Future* and is currently joint Course Team Chair with responsibility for presenting the course to students. Her research interests include environmental education, collaborative networked learning, staff development and supporting students with disabilities.

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Abstract

This paper introduces a new distance learning course, *'Working with our Environment: Technology for a Sustainable Future'*. An inter-disciplinary team within the Technology Faculty of the Open University developed this undergraduate course, which enrols over 1500 students per year. One of the overall course aims is to help students understand how the use of technology to meet human material needs contributes to environmental effects. The process of producing this course, its philosophy, aims and design will be briefly discussed.

At the start of the course a lifestyle environmental assessment activity, called EcoCal, is integrated within students' study materials. The activity enables students to assess the main impacts on the environment arising from their own household's consumption of transport, energy, food and water and production of waste. Through the use either of a printed questionnaire or publicly available software students can calculate their 'ecological footprint' and then consider and model the effects of changes to their lifestyle. Through the combination of undertaking this activity and submitting an appropriate assignment, students are encouraged to think critically and creatively about their personal and household impacts on the environment and how these might be reduced. At the end of the course students were surveyed to explore whether their attitudes and behaviour had changed.

Keywords

Ecological footprinting, Distance learning, Households, Lifestyles, Open University

Introduction: distance learning for sustainability

Supported distance learning through the Open University (OU) enables large numbers of English speaking students in the United Kingdom and continental Europe to participate in higher education. The Technology Faculty within the Open University provides courses that cover a wide range of subject areas, including Environmental technology and management, Systems, International development, Design and innovation, and General engineering. An introductory course at undergraduate level, such as *Working with our Environment: Technology for a Sustainable Future* which is the subject of this paper, has to be open to all students regardless of their previous educational background. With such an open entry policy the course has to provide an introduction to distance learning as well as introducing the necessary study skills and understanding of concepts needed for higher level study.

The course was designed to appeal to students from any background who are interested in learning how to shape a sustainable future. It offers a broad interdisciplinary introduction to the technical, human and social aspects of environmental issues, from local air pollution to global climate change.

The course aims to:

- explore how the use of technology to meet human material needs contributes to environmental effects;
- explore how technology may be used to protect the environment and move towards sustainability;
- support students' development in a range of analytical, communication and learning skills appropriate to the subject matter and level of the course.

Production of the 'Working with our Environment' course

Within the Open University courses are developed using a course team model.

Academics on this course team represented the disciplines of Design and Innovation, Systems, Development, Environmental Engineering and the Energy & Environment Research Unit. There

were also academics who considered the presentation of the courses, the selection, appointment and development of part-time tutors, and the development of students' study skills. Other personnel within the University, such as editors and specialists from graphic design, production, purchasing, audio-visual production and educational software, were also used as appropriate throughout the course's development.

Regular meetings of the team, and exchanges using a course team computer conference, identified and resolved a number of issues surrounding access to the course and the underlying pedagogy. In an attempt to keep the course as open as possible it was decided at the beginning of the discussions to offer a computing and a non-computing route through the course materials. The course team acknowledged the need to develop information handling and critical reading skills by adopting a resource-based approach for parts of the course. This resource based learning uses diverse sources to make students active learners and has the following benefits:

- makes provision for individual student backgrounds;
- allows students to have some control over their rate of study and route through the course;
- offers a wider range of print and non-print resources to motivate interest;
- promotes the acquisition of research, search and selection skills.

Course content

There was also a deliberate progression through the four Themes of the course (detailed below) from consideration of personal and household lifestyles and their implications for the environment to a broader consideration of the global implications of technological and economic development. The course is presented as a series of four main Themes and three resource Files, together with an Introduction and Conclusion. The themes are:

You and the environment

How individuals affect the environment and how household environmental impacts might be reduced. It includes two practical activities. The first enables you to assess the 'ecological footprint' of your household (or another suitable one) on the environment and to consider how to reduce it through technical and lifestyle changes. The second assesses the energy efficiency of your home and how its energy consumption could be reduced. The theme also considers the extent to which household-level changes can tackle global environmental issues.

Travelling light

The effects of personal transport on the environment, and how the transport system could be made sustainable through a combination of technical, behavioural and social changes. You will consider your own transport patterns and how they might become more sustainable.

Food chains

The relationship between the food purchasing decisions of individual consumers and the sustainability of the food supply in Europe and in the world. You will consider your diet and its implications for your health, the food supply system and the environment, and learn to read critically articles about controversial issues such as the role of genetically modified crops in the food supply.

Thinking globally

The implications for the environment of today's highly interconnected world and the huge gaps between rich and poor countries. For example, you will examine the environmental and other issues raised by developing countries' assertion of their 'right to development'.

Throughout the course there was recognition of the need for an interdisciplinary approach. This follows directly from the interdisciplinary nature of environmental problems (Foster, 1998). But, as with any interdisciplinary team, there were certain challenges and conflicts within the team as well as opportunities for group learning and lively discussions of concepts, values and lifestyles. Two of the course's authors were used to open up the values associated with particular lifestyles and there was discussion within the course material of the values implied by the lives of these two individuals – described as 'environmentally sanctimonious Gordon' and 'environmentally slack Tom'. A third character, who lived in a developing country was introduced within the material of the fourth theme as 'environmentally dependent Afi'. It was during the preparation of this last theme of the course, *Thinking globally*, where some tensions within the team began to emerge. Was the discussion of globalisation and development sufficiently 'technical' in a course about technology and the environment? The counter argument started from the premise that both technology and the environment cannot be separated from the social, political and cultural facets of life. Again as a result of team discussions these issues were opened up in the course material so that it was made explicit that the final 'product' represents an accommodation of different emphases, and students were encouraged to engage critically with the content. In this way there is a recognition that 'the knowledge base of environmental higher education is problematic in its objectivity, truth and certainty and frequently subject to contestation' (Jones and Merritt, 1998).

The EcoCal ecological footprinting activity

Within the first Theme, the focus is strongly on the individual student and their immediate household. The importance of households for the environment is well established, where for example in the UK homes are responsible for nearly a third of energy delivered and a quarter of carbon dioxide emissions. For students to engage with this knowledge and consider their own lifestyle and values they carry out an activity using a household environmental assessment technique called EcoCal – originally developed for a UK environmental awareness campaign called *Going for Green*.

The EcoCal activity is based on an environmental indicator called the ecological footprint (EF). The ecological footprint of a given population (e.g. a household, city or nation) is the total land area – of world average biological productivity – required to indefinitely support that population's lifestyle at a given level of technology (Chambers, Simmons, C. and Wackernagel, 2000). The footprint includes the land to absorb its carbon dioxide emissions (the so-called 'energy land'), to accommodate buildings, roads, etc. ('consumed land') and to provide food ('farm land') and forest products ('forest land'), as shown in Plate 1.

TAKE IN PLATE 1

Plate 1. Summing the land requirement for all significant categories of consumption and waste estimates the ecological footprint (EF) for the population of a household, city or nation.
Source: Roy, 2000 adapted from drawing by Phil Testemale in Wackernagel and Rees, 1996

EcoCal calculates the EF that arises from a particular household's activities in Transport, Energy, Water, Shopping, House & Garden, and Waste. It gives individual scores for each topic and a total household score in 'ecocals', where *100 ecocals = 1 hectare*. This method of scoring, with its analogy to food calories and dieting, was thought to be more comprehensible to the public than the ecological footprint. EcoCal is available as either a PC computer program or a paper questionnaire (Going for Green, 1997). Whichever version is chosen, users – in this case our students –enter information about their household and lifestyle for each topic. For example, on the Transport screen (Plate 2), students were asked how much vehicle fuel is used by members of their household each week, how far they travel by bus and train, and so on. The data does not have to be very precise, but nevertheless it was found necessary to give students detailed guidance on answering each question through a set of additional *Instructions for using EcoCal* specially written for the

course. Having entered the data students could compare their household's scores with those of typical UK households and get some suggestions for reducing their footprint (Figure 1). For transport there are fairly obvious suggestions such as using trains, buses or cycling wherever possible. In the EcoCal activity for the course these suggestions were used to encourage students to think creatively of further ways of reducing the environmental impact of their household.

TAKE IN PLATE 2 AND FIGURE 1

Plate 2. Data entry screen for Transport in the computer-based version of EcoCal.
Source: EcoCal software is copyright © Best Foot Forward Ltd. (http://www.bestfootforward.com). EcoCal can be downloaded free *for UK use only* from http://www.tidybritain.org..uk

Figure 1. Chart for comparing your household score for Transport with an average UK household of the same size. Plus some suggestions for reducing your household's score, all from the paper-based version of EcoCal.
Source: Open University (2001) adapted from Going for Green (1997)

Completion of this activity is directly connected to the continuous assessment for the course. As one of the options within the first assignment students are asked to write a report of about 1500 words outlining the results of the EcoCal activity, including their household's EF scores and the changes that they were likely to implement to reduce their household's environmental impacts.

EcoCal results

In 2000 there were over 1800 students at the start of the course in the UK and continental Europe. Nearly 1250 completed the first assignment, the majority of whom reported on the EcoCal activity (the other option was a report on home energy efficiency). For the total sample of 692 Open University students who submitted an EcoCal score sheet the average household size was 2.9 persons (2.1 adults and 0.8 children under 16 years old). About three-quarters of these households were in urban/suburban locations while a quarter were located in rural areas.

The average ecological footprint of this sample was 3.34 ha per household, or 1.33 ha per person. Since OU students are mature, often with experiences of employment and parenthood and their households are similar in size and composition to British averages, their results should be fairly representative. Indeed, these findings are very similar to those of another household footprint study that used EcoCal. That study of 42 UK households, also averaging 2.9 occupants and representing a variety of socio-economic types, produced an average household footprint of 3.6 ha, or 1.24 hectares per person (Simmons and Chambers 1998; Chambers, Simmons and Wackernagel, 2000).

From a statistical analysis of the data (Roy and Caird, 2000) the contributions to the total household ecological footprint per person for the whole OU sample are in rank order from Transport, Energy, House & Garden, Shopping, Waste, and Water.

TAKE IN FIGURES 2 AND 3

Figure 2. Average EcoCal scores per person for households with and without children
(100 ecocals = 1 ha footprint)

Figure 3. Average EcoCal scores per person for urban/suburban and rural households
(100 ecocals = 1 ha footprint)

An analysis of the differences between the households with and without children, and between the urban/suburban and rural households, was also conducted (Figures 2 and 3).

Perhaps not surprisingly, households without children had higher footprints per person than households with children, since children under 16 years generally use fewer resources than adults and older children (Figure 2). In particular, households without children had almost three times higher per capita Transport footprints than the households with children. This is probably due to

higher disposable incomes of households without children and a freedom from the commitments associated with younger children, both allowing greater travel. Households without children also had significantly higher average Energy footprints than those with children. This is probably due to more electrical appliances in households accommodating older teenagers and larger living space per person of childless households or whose children have left home. Households without children also had twice the average footprint for Shopping of households with children.

As expected, given the lack of public transport and greater travel distances for those living outside towns, the rural households had higher average Transport footprints than the urban ones (Figure 3). Rural households comprising all adults or adults and children over 16 years had the largest transport footprints of all.

Such differences were reflected in differences in the relative contribution of the different consumption areas to the total household footprint per person. Transport and Energy were the most important components of the ecological footprint in all cases. For the whole sample, Transport and Energy accounted on average for nearly three-quarters of the total household EF per person. So, although EcoCal Waste and Water footprints are now recognised as underestimates (Chambers, Simmons and Wackernagel, 2000), our results reinforce the conclusion of many other studies (e.g. Brower and Leon, 1999) that transport and energy are the key issues to address in order to reduce the environmental impacts of households.

Ideas for reducing household footprints

As noted earlier, the OU students used EcoCal not only to assess the EF of their households but also to consider how to reduce those footprints. As part of their assignment report on EcoCal students submitted their ideas for achieving a more sustainable lifestyle.

A qualitative analysis of the ideas contained in twenty-two randomly selected assignments was conducted. Table I summarises some of the most frequently mentioned ideas for reducing household footprints in the key areas of transport and energy. These were all ideas that the students said they were likely to implement, either in the short or in the longer term. EcoCal itself suggested some of these ideas. The students, often in discussion with other members of their household, generated other ideas.

TAKE IN TABLE I

The ideas were not especially novel. But it is interesting that these students were willing to seriously consider implementing some fairly radical ideas for reducing the ecological footprints of their households, such as moving house to reduce transport impacts or installing renewable energy systems.

Evaluation: moving towards sustainability?

It appears from our data that the ecological footprint per capita of the Open University student households is close to the average for the UK of about 1.3 ha per person. However, it is estimated that a globally sustainable UK household ecological footprint (as measured by EcoCal) is about 0.5 ha per person (Roy and Caird, 2001). If we accept these estimates 11% of the OU households could be regarded as ‘sustainable’, in the sense of having a footprint per person no greater than the average biological capacity per capita of the earth. Most of the OU households that achieved such a sustainable footprint did so by having much lower than average impacts per person in all areas, but especially transport.

Of course, the majority of our sample households had footprints well above this global sustainability target. An average OU household would have to reduce its footprint by 60-70% to achieve sustainability. Again there are some hopeful signs. As was outlined above, a random sample of these OU students indicated that they planned to reduce their household’s footprint in the

key areas of transport and energy through a variety of simple short-term and more radical longer-term measures.

Evidence that at least some of the students had actually implemented their ideas for reducing household footprints, came from an environmental audit conducted at the end of the course. As part of this audit a sample of 206 students completed a postal questionnaire that included questions about changes in their behaviour and attitudes as a result of taking the course.

For example, the following questions were asked. 'As a result of taking the course':

'have your general household patterns of travel changed in any way?';
'have your general household patterns of consumption of energy and materials changed in any way?';
'have your attitudes towards the environment changed?'.

Many students mentioned changes in their travel patterns, such as:

'I now cycle to work.'

'Cut down on unnecessary journeys – better planning.'

'Have scrapped our second vehicle and use public transport or walk instead.'

'Car sharing as a result of the course. Also bicycle bought and used on warmer days.'

'Moved house to reduce travel to and from work'.

A number of students also mentioned changes in their household consumption of energy, materials and food, for example:

'We now recycle cardboard and plastic as well as glass and cans. We shop for food now with an awareness of "food miles" and unnecessary packaging and what's in-season'.

I have carried out insulation, i.e. loft and windows, to help prevent heat loss.

'Buy only two newspapers per week, recycle everything possible, compost all relevant household waste, changed all lighting to low energy.'

Attitudes similarly did seem to change, with views expressed such as:

'Better awareness of how my lifestyle can affect the environment, discussing their effects with friends and family to raise their awareness.'

'I am now always more conscious of the effect any of my actions may have on the environment.'

'*Since doing the course I have found many people at work interested in "the environment". I have also become aware of lots of activities on the environment my company is involved in which I previously had no idea about.'*

For some it was the realisation of the complexity of the issues or a deeper understanding:

'Realisation of the scale and complexity of trying to change human behaviour and environmental problems.'

'I'm more aware of the complexity of caring for the environment and now wish to work in this field.'

'I'd already realised that the care of the environment was becoming a big issue. This was one of the reasons for taking this course in the first place, but studying a little deeper helped me become more aware and gave more depth.'

'I don't think my ideas have changed, simply strengthened and widened.'

Conclusion

The use of a practical environmental assessment activity, such as EcoCal, that focused on real lifestyles was very popular with students. The household ecological footprints measured were comparable with those produced in other UK studies. Transport and energy were the most important components of the total footprint and showed significant differences between households with and without children and between rural and urban households. From the responses to the course environmental audit there was evidence that studying the course had raised students' awareness and understanding of environmental issues. There had been personal consideration of lifestyles and discussion of environmental issues within households that in many cases seem to have prompted genuine changes in attitudes and behaviour.

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Table I. Summary of students' ideas for reducing the environmental impacts of their households [1]

Transport	**Energy**
Drive at lower speed	*Switch electrical appliances off when not in use*
Replace car with smaller more fuel-efficient engine	*Fit a condensing or combination boiler for central heating*
Take UK holidays rather than go abroad or travel to less distant destinations by air	*Wind dry clothes on line rather than tumble dry*
Join a car pool for work, school run and shopping. Give up car.	Reduce heating demand by using a heating control timer, *lowering room temperatures and wearing extra clothing*
Set up a flexible household transport plan, i.e. using public transport or walking and cycling	*Stop draughts* and insulate *loft*, cavity walls, and windows.
Travel less by air and car and use train and coach more for long journeys	Replace appliances with energy efficient models e.g. refrigerator, freezer, washing machine, dishwasher, 'Savaplug', *fluorescent lamps*, etc.
Work more from home	Replace electric cooker with gas
Move house to be closer to work and shops	Use green energy, i.e. renewable sources, such as solar energy, and/or 'green' electricity

1. Ideas in *italics* are suggested by EcoCal.