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Waste Minimization Using Behavioural Change Techniques: A Case Study for Students

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Abstract
Through assessing the triggers, motivators and barriers for leading a more sustainable lifestyle, behavioural and/or attitudinal change in students at the University of Southampton has been investigated. Using existing theory-based literature and extensive primary data collection and analysis, links between waste-related behaviour and attitude have been found. It is observed that pro-environmental behaviour can exist independently to pro-environmental attitude, depending on where barriers occur within the chain of causality, and based on the level of both specific and general environmental awareness. It is suggested that in order to alter behaviour, awareness must be increased, with an associated reduction in situational barriers. Awareness can be altered through the provision of relevant information. Furthermore, although some level of behavioural change was achieved; additional monitoring and a sustained behavioural change programme over a longer time period is proposed.

1 Introduction
Recycling of household waste has become a very problematic area of British local government policy-making in which central government has set ambitious targets. In today's "convenience society", young people, especially university students, pose a particular problem because they are a transient group that frequently has no formal responsibility within a household for, or experience of, waste management activities. Recycling initiatives frequently utilise behavioural change techniques in order to achieve effective results (Barr *et al*, 2001). Schultz *et al* (1995) examined numerous studies into recycling behaviour, identifying links, limitations and areas for additional research, which this study draws on. Recycling, however, is only one method of waste minimisation, with reduction and re-use being the preferred options. Behavioural change at all levels of the waste hierarchy was focused upon throughout the study.

This paper reports on the extent to which the lifestyles of students attending

the University of Southampton in England are sustainable (see Table 1 for detailed aims and objectives). Current behaviours were assessed and triggers, motivators and barriers to leading more sustainable lifestyles were identified. The effectiveness of different behavioural change techniques towards initiating behavioural and/or attitudinal change in students was investigated and evaluated.

Tab. 1: Aims and objectives of the study.

Principal aims	a) Assessing the extent to which student lifestyles are sustainable
	b) Assessing triggers, motivators and barriers for leading more sustainable lifestyles
	c) Assessing the effectiveness of different behavioural change techniques towards initiating behavioural and/or attitudinal change in students
Subsidiary objectives	a) To identify the type and amount of waste generated by an average student, and the source and destination of this waste
	b) To identify methods to reduce waste generation, energy use and unnecessary consumption by students through altering behaviour and/or attitude
	c) To identify different practices, procedures and products used by students from differing backgrounds
	d) To identify what impact different behavioural change techniques have had on the levels of sustainable living witnessed
	e) To identify methods of altering practices, procedures, or products to enhance the ability to live more sustainably

2 Methodology

In order to test whether different behavioural change techniques are able to affect the attitudes and/or behaviour of students, and to evaluate to what extent any changes occur, a small number of student households were asked to take part in a behavioural change programme. For the wider study two primary methodologies were undertaken: 1) a baseline questionnaire survey and 2) a four week behavioural change programme, including two focus groups and a second, more specific questionnaire on environmental barriers, attitudes, awareness levels and behaviours. This paper will focus on the behavioural change programme only.

To minimise the well known 'over reporting' effect (Brook Lyndhurst, 2004) quantitative data (e.g. types and quantities of waste generated, consumption patterns) were obtained in addition to self-reported behaviour. Monitoring and a

post-study focus group enabled any changes in behaviour and/or attitude that may have taken place to be identified. The behavioural change techniques used included: removal of situational barriers, feedback, goal setting and prompting of information.

Forty-six potential participants (33%) were identified from the 141 who answered the baseline questionnaire via answers to a question about further research. Seven households were eventually selected, ensuring a suitable range of year groups, numbers of housemates and dwelling types.

Following a pre-study focus group, a questionnaire was used to record the participants' awareness, attitudes and knowledge of environmental issues, together with self-reported behaviour. Previous studies (including Corraliza & Berenguer, 2000; Costarelli & Colloca, 2004; Curran, 2003; Borgstede & Biel, 2002) show that awareness influences attitude and, in turn, attitude influences behaviour. A chain of causality (see Figure 1) can therefore be inferred. In order to alter behaviour, variables at all stages of the chain must be investigated. The questionnaire was therefore devised with statements about each of the four variables, for numerous waste and consumption related topics. Statements with a common topic theme were written; starting with a statement about behaviour, the attitude a student needs in order to adopt that behaviour was determined. From this attitude, the type of knowledge needed to influence that attitude was sought. The main barrier interfering with the group of topic-linked statements was then identified and links between these statements were constructed to relate one statement to another creating a chain (see Figure 2). Each chain was then numbered. Analysis of chains establishes where limitations to behavioural change can occur. The extent to which participants were inhibited from achieving behavioural change was identified by analyzing the strength of the links between individual statements and the strength of the whole chain.

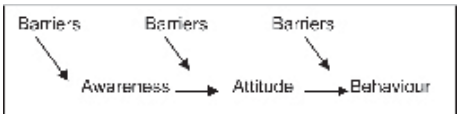


Fig. 1: Chain of causality between variables

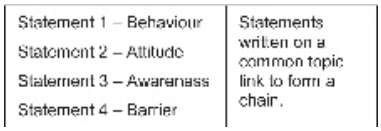


Fig. 2: Chains of statements

After the final week of monitoring, participants were given a copy of the same questionnaire to fill in. As participants were not aware of this when they started the programme, it was deemed unlikely that they would remember their initial answers. The two questionnaire responses were compared to identify whether any changes in awareness, behaviour or attitude had been established, and to measure the overall effectiveness of the behavioural change programme. Questions were polarised so that a positive answer did not always relate to a pro-environmental response, to make participants think about their answers more

carefully.

The behavioural change programme took place for four weeks over a two month period between March and April 2006. A focus group was held to introduce the participants to the study, and data on 'current' (or existing) behaviour and attitudes was collected (week 1). Various behavioural change techniques were employed during weeks 2-3, as well as monitoring of behaviour and waste audits. After a four week break in communication over the Easter vacation, data on behaviour and attitude were collected to identify any changes that may have taken place. The behavioural change programme included:

- Provision of incentives (introduced to the participants as 'Resource Management Aids');
- Use of behavioural change techniques;
  - Provision of general information (leaflets and verbal introductions to waste management);
  - Provision of further specific information (daily email on a specific topic, gained from reliable and readily accessible sources (e.g. Ecologist magazine or the BBC website); and
  - Goal setting.

A waste audit was carried out at all households in order to inform the behavioural change techniques that were used in the latter part of primary data collection. This involved weighing the main household bin and noting when it was last emptied. The audit was conducted the day before Council refuse collections were made as it was hoped bins would be at their fullest. Using a plastic groundsheet and protective gloves, the contents of the bin were emptied and sorted into labelled boxes according to whether waste items could have been reduced, re-used or recycled instead of disposed of. The remaining waste was further sorted into component materials, which generally included plastic packaging, food waste, metal foil and others. Each pile was then photographed and weighed before returning the material to the bin.

3 Results and Discussion

3.1 Trends after the behavioural change programme

Pro-environmental waste-related attitudes increased from 55% before the study to 77% afterwards. Responses regarding barriers and behaviour also became more pro-environmental after the study, with mid-environmental responses increasing by 8%. In particular, pro-environmental awareness of consumption related-issues (one of the topics chosen for a chain of linked statements) jumped from 39% to 54%, with non-environmental awareness reducing by two thirds from 18% to 6%. The increases show the effectiveness of the targeted information campaign.

3.2 Chains

The chains were analysed so that any links between barriers, awareness, attitude

and behaviour were determined. The strength of correlation between each set of variables per chain was tested using the Pearson Product Moment Coefficient. The correlations obtained were modest (r = 0.40–0.69) and strong (r = 0.70–0.89), although there was an increase in the number and strength of significant correlations after the behavioural change programme. This illustrates the programme's success in increasing participants' association with environmental issues. Community involvement (waste chain 5) showed the greatest increased correlation for all statements suggesting opinions became more pro-environmental.

Of the statements relating to consumption, five of the six statements of chain 1 (consumer choice) had a significant correlation before and after the programme, with 'preference' (chain 6) scoring similarly. The greatest increase in significant correlations related to chain 5 (waste), although there was no increase with relation to barriers for chain 5 suggesting that there are still considerable waste-related deterrents to pro-environmental consumption.

3.3 Influence on individuals

For the participants who received all behavioural change techniques, the pro-environmental score relating to awareness, attitude and behaviour increased. Scoring of waste-related barriers did not alter. Consumption related awareness, attitude and behaviour also showed an increase for these participants, although participant AG showed less of a change. Of all participants, AG was the most environmentally cynical, which could reflect his lower level of pro-environmental gains compared to the other participants. This would suggest, in support of Corraliza & Berenguer (2000, pp 837), that pre-existing attitudes inhibit pro-environmental change; for example, MR and JC were much more receptive to the programme, and asked numerous questions about the study on each visit.

The two participants (SN and EB) who were set goals, but did not receive specific information showed no alteration in barrier-related links, although awareness increased by five points each and attitude was reduced slightly. Setting targets, therefore, appeared to increase awareness levels; the participant was been asked to focus specifically on a section of their daily lives that would not usually be given excessive attention. Consequently, participants will probably give more thought to the matter, and possibly even seek out more information for themselves.

Since the scoring of barriers was unchanged, it can be inferred that information is necessary, at least to some extent, to reduce barriers. Pro-environmental attitude may have reduced since the participant was required to put in more effort relating to the topic. Since there was little information to support this increased effort, the perceived 'cost' will have increased, leading to a more negative, or less-environmental attitude, again in support of Corraliza & Berenguer (2000, pp 837).

Looking at the statements relating to waste, it seems that barriers act as a limiting factor for subsequent statements further along the chain. KM increased the

score regarding waste barriers by 10 points (the greatest change showed by any respondent to any statement), with other increases of at least three points for awareness, attitude and behaviour. LS, on the other hand, showed a reduced score for waste barriers by three points, with a negative scoring of the other three waste sections. For both participants the greatest difference in scores (excluding barriers) was related to attitude. This would be expected, and concurs with the above observations on consumption and attitude, since the removal of situational barriers is likely to increase ease of the activity. The participant therefore has to input less effort for the same, or a greater, result, leading to an altered perception of the activity. Similarly, if situational barriers are encountered where there were previously none, the opposite should be expected.

The only decrease in waste-related attitude was shown by the two participants who, at the outset of the study, were already keen recyclers (LS and SN). The same is true of waste-related behaviour for these participants. In keeping with the above explanation, this could be because the existing behaviour of these participants was altered for the duration of the study, resulting in an increased amount of effort that was required on their behalf.

3.4 Use of incentives

Following the use of the 'resource management aids', participants were asked to provide feedback on the usefulness, or otherwise, of each aid that they had been given for the duration of the programme (see Table 2).

Tab. 2: Participant feedback on incentives used in the behavioural change programme

Incentive	Positive comments	Negative comments
Stacking 'convert' bins (recycling bins)	"They were really cool" – pleased with aesthetics of the items and found easy to use	"A complete waste of time" – previously had a perfectly good system
	Neater than previous system	Not that easy to use
	Used them more than previous internal recycling arrangements	Had to be cleaned more often than previous system
	Level of recycling increased because of them	Hard to remove content of boxes to transfer to kerbside bin
		Since all items are collected in one container at the kerbside, one box for all materials internally would be preferred

Money off vouchers for Ecover cleaning products	Were used by participants, and passed to family members/ friends.	Incorrect reading of the expiry date meant some vouchers were not used (user error)
	Conversion of non-Ecover user to Ecover user as trial or product reduced scepticism	No new products were needed during the study for some participants as previous products were bought in bulk
	Liked environmental approach of the company (turf roof)	Will remain with preferred brand and cheaper items
Canvas shopping bag	Plastic bags get re-used	"Haven't used them yet"
	Very sturdy	Seen as 'girlie' by males
	"Use them all the time", plus usage of rucksacks	"Absolutely useless" – do not feel as substantial as plastic bags
		No flat base, 'thin' design of bag limited capacity
		Not convinced by single stitching of handle on the bag
Fat Traps	Previously used similar container to collect cooking fats and oils	Fat does not congeal properly, so difficult to use as bird food
	Able to re-use the container as emptied out fats onto bird table	Seems wasteful to use a plastic container and then throw it away
		Concern about the funnel melting when hot oil is poured onto it; not needed; bad design
		Oil is only poured down the sink when hot/ warm. When cold it can be scraped into the bin, so fat trap is not necessary
		A bottle shape would have been preferred: easier to pour into
		Screw-fit lid was hard to use
Can crusher	Fun to use	Forgot we had one, not used
	Crushes food and drink cans	Two or three stage process
	Useful for reducing space in the recycling bin	Plastic is not that sturdy, showing signs of use already
	Uses recycled plastic	Cannot operate it
Envelope re-use labels	Envelopes are saved to be re-used	Didn't remember receiving any
		Do not look like they are adhesive
		Used water to wet adhesive, rather than saliva, and did not stick properly to envelope

4 Quantitative data

4.1 Waste Audit

As Figure 3 shows, average daily bin weights show a clear trend, with weeks one and two being greater than weeks three and four. This was particularly noticeable for EB: in the first two weeks 1.4 kg or more of waste was produced, before the receipt of incentives. This was reduced by half once recycling boxes were in place; previously no items were recycled as there are no recycling facilities in the Halls of Residence or nearby.

The bin weights for LS and SN were lower than other participants as they were keen recyclers before the study took place, and already separated recyclable items from their refuse. The increase in weight of SN's bin in week two was due to a housemate moving out and disposing of unwanted items. Apart from this anomaly, the bin weights for these participants are the most consistent, highlighting the effect of their pre-established recycling habit.

The final bin weights of EB and KM are slightly greater than in week three. This suggests that, after the four-week break in communication, pre-programme habits started to return. The same is not illustrated by MR, AG, or JC, possibly since these household members were not present in Southampton over the Easter break. At the time of the final visit, therefore, they had only been back in their dwelling place a few days and had not yet accumulated the amount of waste that would usually be expected over a week. Had more time been available, the study would have been extended to determine whether lasting behavioural change had occurred.

The waste audit included segregating bin contents into 'reduce', 'reuse' or 'recycle' piles. Figure 4 shows that as the study progressed, the number of items able to be removed from the waste stream reduced as participants learnt what could be recycled, and attempted to alter their behaviour accordingly. Items in the 'reduce' pile included excess food that had been bought but not eaten and plastic bags, able to be replaced by re-usable canvas or strong bags. Items for reuse also included plastic bags, as well as plastic tubs and drinks bottles (use as storage containers), bubble wrap and even a spoon! Recyclable items were most numerous and included mainly glass bottles or jars, compostable food scraps (although only 2 participants had a compost bin available), tin cans and paper or card from packaging. Kerbside collection of glass is currently not available in Southampton.

In relation to Figures 3 and 4, reduction of items per pile during the study can be explained by:

- Increased knowledge about what can be recycled
- Provision of in-kitchen recycling facilities
- Greater consideration of what is put into the bin
- Visual reminders (recycling boxes)
- More careful consideration of items purchased, minimising the level of waste being created

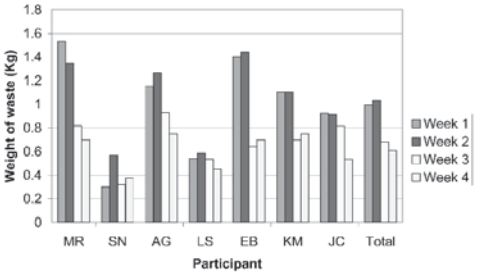


Fig. 3: Average daily weight of kitchen waste per week in each participating household for the duration of the behavioural change programme

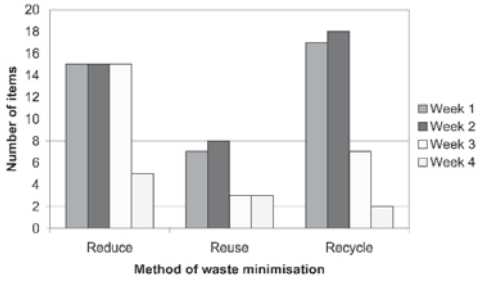


Fig. 4: Cumulative number of items removed from the waste stream of all households during each week of the study

5 Conclusions

5.1 Assessing the sustainability of student lifestyles

This study has encompassed a range of methods and analyses to determine the level of sustainable lifestyles of students. The amount and type of waste generated by a student household was closely linked to consumption factors. In addition, the amount and frequency of recycling undertaken is reflected an interrelation of the factors listed in Table 3. The types of products purchased also rely on a number of influencing factors (Table 4).

Tables 3 and 4 are by no means exhaustive lists of influencing factors, but highlight some of the conclusions formed during this study. The sheer number and variation of factors highlights the level of difficulty in determining how sustainable a lifestyle is. Recommendations for how a greater level of pro-environmental behaviour can be stimulated, formed largely from analysis of the general questionnaire, include the following:

- increase awareness of individual impacts on the environment
- provision of mechanisms to encourage voluntary uptake of pro-environmental measures
- examples of best practice
- provision of tools that enable change to take place

Tab. 3: Factors influencing the amount and frequency of student recycling behaviour

• Situational barriers (such as lack of kerbside collection, internal recycling containers and composting facilities, type of accommodation)
• Attitudinal disposition (a more pro-environmental outlook facilitated greater recycling)
• Levels of awareness (knowledge of relevant information alters attitudes to some extent, and further facilitates pro-environmental behaviour). This includes practical information such as which items are able to be recycled, as well as wider information such as the reasons for recycling
• Concern for the environment, often related to effect on the individual, as well as value of nature
• Parental influence and habitual behaviour
• Connection with the local community
• Perception of ability to make a difference
• Effort required by an individual, and effort perceived to be made by other parties, such as the Council or manufacturers

Tab. 4: Factors which influence consumption-related behaviour

• Availability of the product, for example organic or locally sourced items
• Cost of the product
• Convenience of the product/ time available
• Attitude of the individual towards the environment
• Knowledge about pro-environmental alternatives
• Lack of concern/ more pressing issues
• 312 lock-in and disincentives for pro-environmental behaviour
• Operational challenges, e.g. limited transport (although has not been considered in this study)
• Packaging and/or marketing of a product
• Concern for the environment, often related to effect on the individual, and the value of nature

- gaining trust and confidence from participants to enable long term commitment

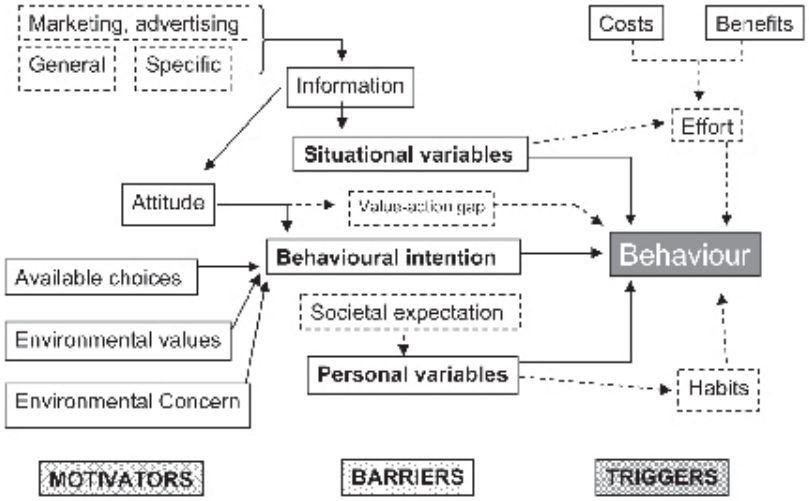
In a wider context, Seyfang (2004) highlights that pressure from individuals alone cannot increase sustainability unless supported by Government and the implementation of policy decisions; this is starting to be addressed by UK authorities (Sustainable Development, 2006).

5.2 Identifying successful behavioural change techniques and the level at which behaviour has altered

This study has demonstrated that personal *and* situational variables act as triggers, barriers and motivators to pro-environmental change and that pro-environmental behaviour can exist independently to pro-environmental attitude. Discovery and quantification of the interrelation between such factors on a single, or occasionally pair of topics has been attempted before (Schultz *et al*, 1995; Chan, 1998 and Jackson, 2005; for example). Few studies, if any, have attempted this for personal and situational variables together for a number of sustainability indicators.

Of the behavioural change techniques studied, removal of barriers combined with provision of information and goal setting seems to have created the greatest change in behaviour. Other factors, such as personal variables, also affect the level of change seen. Changes in behaviour were clearly witnessed, and these changes were continuing to be employed during the follow up period a month after the programme had ended.

Various attempts have been made to model influences of behavioural change, for example Ajzen and Fishbein's 'Theory of Reasoned Action' (Chan, 1998) and Corraliza & Berenguer's Interaction and Level of Conflict between Personal and



Situational Variables (2000). Using the understanding gained from this study, and evidence from previous work, a new model of the main influencing factors is shown in Figure 5. Changing behaviour is, and remains to be, a complex area with numerous influencing factors. Greater understanding of the influence of each factor, through studies such as this, will aid further levels of pro-environmental behaviour to be seen.

Fig. 5: Model of interaction of variables leading to behavioural change

6 References

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