An Investigation into Effective Methods for Teaching Social Sustainability within Product Design in British and Irish Universities

by

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Abstract

Consideration of sustainability in product and industrial design courses is becoming more common and relevant within higher education in the UK. However little is known about how widespread the teaching is and what is actually understood as sustainable design with discrepancies' in the definitions used in different institutions. Literature highlights that many universities now engage with the tangible environmental aspects of sustainable design, whilst the intangible social aspects are left unaddressed. This thesis explores methods for encouraging and enabling students to address the social aspects within sustainable product design (SPD) education.

The first research stage presents the results of a nationwide survey, which investigated how widely SPD is taught, which social aspects are addressed, how SPD is taught and assessed and the attitudes and awareness of it amongst academics. The second research stage presents further research into best practice in SPD through detailed interviews with leading academics in the field. A third research stage built upon the findings from both these studies, and sought to address a perceived weakness in SPD education; the lack of understanding and consideration of the social aspects in sustainable product design in teaching and project outcomes.

Three 'Rethinking Design' workshops were developed and tested at five universities in the UK and Ireland. These workshops were designed to introduce students to the wider social aspects of SPD, through the use of audio visual group based workshops. The design of the workshops enabled a learning environment where a deep understanding of the social aspects of Sustainable Product Design could be developed through; group work, discussion and critical reflection, which led to students exploring design thinking responses, suggesting that deep learning, had occurred.

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List of Publications

Watkins, M., & Lofthouse, V. (2010). A Review of Sustainability within Product and Industrial Design Courses in British Universities. In B. Boks, C., McMahon, C., Ion, W. and Parkinson (Ed.), Proceedings of the 12th International Conference on Engineering and Product Design Education (pp. 346–351). Trondheim, Norway: Institute of Engineering Designers.

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List of Abbreviations

A/V	Audio visual
BA	Bachelor of the Arts
BSc	Bachelor of the Sciences
CSD	Chartered Society of Designers
EDD	Emotionally Durable Design
EOL	End of Life Considerations
HE	Higher Education
IDSA	Industrial Designers Society of America
IED	Institute of Engineering Designers
LCA	Life Cycle Analysis
LBSU	London South Bank University
MA	Master of the Arts
MSc	Master of the Sciences
NTU	Nottingham Trent University
NU	Northampton University
SPD	Sustainable Product Design
SD	Sustainable Development
UCAS	Universities and Colleges Administration Service
UL	University of Limerick
UWIC	University of Wales Institute of Cardiff

Chapter 1. Introduction

1.1. Background

This PhD study is concerned with the teaching of the social aspects of Sustainable Product Design (SPD) within British and Irish universities. Prior doctoral studies that examine Sustainable Product Design education primarily focus on the environmental aspects (Cull, 2005, Clunes, 2009). Cull, (2005) documents the teaching of sustainability to 2nd and 4th year undergraduate students in two Scottish universities, whilst Clunes (2009), considers the application of sustainability by 2nd year undergraduate students in an Australian university. Both Cull (2005) and Clunes (2009) studies use an action research case study approach and focus predominantly on the environmental aspects of sustainability but not the social aspects. Clunes (2009) specifically notes the consideration of social factors in his study, but these are only addressed in relation to changing the user's behaviour or actions in relation to environmental considerations and resource reduction. Such a focus on user behaviour change was also touched upon in Cull's (2005) study. However, the wider social considerations focussing on user needs and encompassing aspects such as equity, justice, need and wellbeing are not considered. This is also reflected in the literature by Vezzoli (2006), who describes such a lack of consideration of the social and ethical aspects of design. This thesis will therefore specifically address this gap by considering effective methods for enabling students to consider the social aspects of sustainability, addressing the difficulties noted in addressing the social aspects by both Cull (2005) and Clunes (2009) research.

1.1.1. Defining the curriculum focus of the research

The following section will outline the focus of the research considering the definitions of Product and Industrial design, highlighting the differences in BA and BSc courses of study and concluding by providing definitions for Sustainable Design (SD) and SPD that will be used in this research study.

1.1.1.1. Industrial or Product Design Education

There are a large number of degree courses offered in the UK that teach both industrial and product design and there is often confusion over the difference in meaning of the two course titles, which are often used interchangeably. A review of the number of courses available through Universities and Colleges Admissions Service (UCAS), the body for university applications in the UK, found a total of 77 courses titled Product Design and only 5 courses titled Industrial Design, with 2 courses titled Industrial Product Design for the 2010 entry. The 5 Industrial Design courses were offered by the University of Bournemouth, Brunel University, the University of Hertfordshire and Loughborough University, all of which also offer Product Design as an additional separate course of study, suggesting that there is a difference in the taught content between the two courses. A review of the course content available on the universities websites showed subtle differences in the structure of the Industrial Design courses at each institution. Some courses had a more technical and engineering focus, whilst other courses included, marketing, management or a specialism such as furniture, toys or sports equipment. However these differences could not be attributed as unique to either Industrial or Product Design, rather the classification of the degree obtained being either a BA or BSc at undergraduate level or MA or MSc at a postgraduate level.

For the purposes of this study 'Product Design' will be used as the default term in this study and will be considered as the same as Industrial Design using the definition given by the IDSA:

> *"Industrial design (ID) is the professional service of creating and developing concepts and specifications that optimize the function, value and appearance of products and systems for the mutual benefit of both user and manufacturer." (IDSA, 2009)*

Product Design has been selected because of its dominant use as a course title; Industrial Design will only be used when referring to a specific university course of that name.

1.1.1.2. Differences between degree designators

This research study considers students from a range of courses, both undergraduate and postgraduate. At an undergraduate level there is typically considered to be a distinction between a course that awards a Bachelor of the Arts degree (BA) and those that award a Bachelor of Science degree (BSc), whilst a small number of product design courses award a Bachelor of Engineering (BEng). This distinction between the BA in Industrial Design and Technology and the BSc in Product Design and Technology at Loughborough University for example is that the BA course is biased towards the user, whereas the BSc is more focussed on the underlying technology of the product (Loughborough University, 2009). Hertfordshire University similarly runs a BA and a BSc course, however the titles are interchanged: the BSc is in Industrial design and the BA is in Product design. The differences are similar to Loughborough with the BSc course placing more emphasis on the manufacturing and technology than the BA, which places more emphasis on user centred design. However the BSc still includes some user consideration such as human factors (University of Hertfordshire, 2008). These underlying differences however are typically small in comparison to the similarities between the courses' content, but demonstrate that differences in the course content would appear to be related to the type of degree that is being awarded, rather than the course title.

This research study considers MSc, BSc and BA courses and so to avoid confusion and in recognition of the subtle differences, the course designator shall be referred to within the findings.

1.1.2. Defining Sustainable Design

Sustainable design is referred to in a number of different and often conflicting ways and is often confused with ecodesign (Tischner and

Charter, 2001) defining sustainability solely in terms of environmental and economic issues. However the researcher would argue that sustainable design should take into account the economic, environmental and social considerations (Elkington, 1998) ensuring that each are maintained in balance, in accordance with the intentions of Sustainable Development:

> “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:
>
> - the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
> - the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.”
>
> (World Commission on Environment and Development, 1987)

The definition of sustainable design to be used in this thesis is illustrated in Figure 1. It encompasses the environmental and economic balance of ecodesign with the additional consideration of the social implications of the product, considering the issues of social equity and fairness as outlined in the definition of sustainable development above.

Sustainable design also considers the concept of needs; both the needs of the user (Bhamra and Lofthouse, 2007), as well as the needs of employees and communities affected by production and the mining and extraction of raw materials.

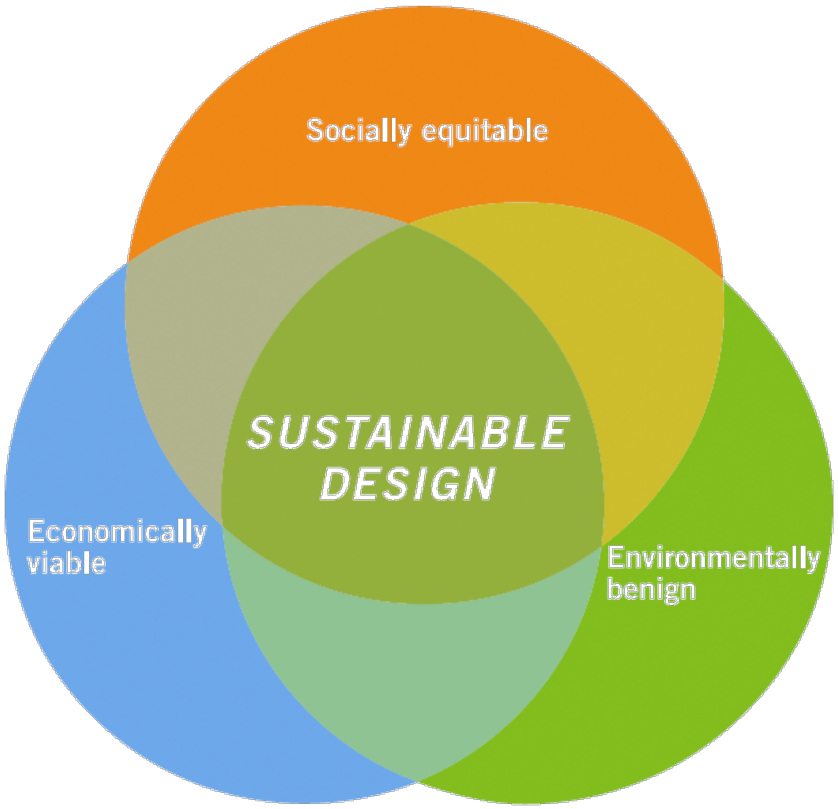


Figure 1 Sustainable Design (White et al., 2005:11)

1.1.3. Social aspects of Sustainable Product Design

For the purposes of this study Sustainable Product Design or SPD will be referred to in recognition that the study focuses specifically on Product Design education. However within this the research is focused on the social aspects of SPD. Literature focussing on this specific area is limited and currently supports two distinct views on how the social and ethical considerations can be considered within the product development process. The first considers the wider social and ethical issues in respect to sourcing and manufacture of the product and how this effects the employees and local community (Datschefski, 2001, Walker, 1998). The second considers the social needs of the user, incorporating aspects of usability, socially responsive use and designing to meet specific human needs (Bhamra and Lofthouse, 2007), encompassing design specialisms such as ergonomics, inclusive and universal design, design for the aged and design against crime (Bhamra and Lofthouse, 2007). Due to this ambiguity a definition of the social aspects of SPD will be explored as part of the research.

1.2. Aim

The aim of this research study is to develop an approach for the successful teaching of social sustainable product design within UK and Irish universities.

1.3. Objectives

- To conduct a review of the literature surrounding the social SPD education, to investigate the current state of the art in the field.

- To conduct a nationwide survey to investigate the state of SPD within the UK, seeking to address gaps evident from the literature review.

- To identify both best practise and limiting factors for the successful delivery of SPD education by conducting interviews with leading academics in the field.

- To develop and implement effective educational interventions in product design courses that help to facilitate an understanding amongst undergraduate students of the social aspects of sustainability and encourage students to consider these within their design practise.

- To evaluate the effectiveness of these interventions in enabling students to fully understand and consider the social aspects of sustainable product design within their assessed outcomes.

- To draw conclusions from a wide sample so that the findings can inform and enhance future teaching and learning in SPD within British and Irish universities.

1.4. Scope

To investigate how the social aspects of SPD are currently taught within British and Irish universities, considering the most effective teaching methods for enabling undergraduate and postgraduate students to grasp the complexity and apply their learning of the social aspects of sustainable product design. The focus upon British and Irish Universities should enable conclusions to be drawn that can be replicated in other universities with similar course structures within the British Isles.

1.5. Background of the Researcher

The researcher has a particular interest in effective design education, which was initiated and developed through prior experience as a qualified secondary school teacher, teaching Design and Technology for three years, to mixed ability learners aged 11 to 18. In 2005 the researcher wrote a report on the effectiveness and potential implementation of e-learning in further education for an EU funded FP6 project (Watkins and Wimpenny, 2005). This work influenced future teaching, resulting in the development of a variety of electronic resources and techniques to support the teaching and learning of complex aspects of the curriculum. The researcher has also practiced classroom based action research in secondary education, investigating the effects of different types of music on pupils' concentration. This led to a more focussed study considering how fast music and images could be used to promote rapid concept generation. It is this knowledge and grounding in design education that the researcher sought to build upon throughout the course of this PhD, focussing specifically on the social aspects of sustainability within product design education in British Universities.

In addition, since commencing the PhD, the researcher became a visiting lecturer in Sustainable Design at the University of Hertfordshire teaching Sustainability across different disciplines in the School of the Creative Arts. This has provided the opportunity to conduct teaching that is informed by the research presented in this study.

1.6. Outline of the Thesis

This thesis consists of ten chapters, the first of which was the introduction including the aims and objectives of the research.

Chapter 2 presents a literature review considering a number of key areas relevant to sustainable product design in Higher Education. This chapter addresses educational theory as well as subject related material. The various themes explored in this chapter include:

i. Current thinking in Education for Sustainability highlighting key considerations to fostering an understanding of sustainability.
ii. Consideration of the learning preferences of designers and the current generation of students.
iii. A consideration of current literature within the field of SPD education, exploring the different approaches and techniques described in the literature.
iv. Social sustainability design requirements are explored and discussed.
v. Teamwork within design education, considering the benefits and potential pitfalls.

Chapter 3 outlines the methodological approach to be used with the three research stages involved in this research study, addressing the application method, data collection and analysis techniques.

Chapter 4 outlines empirical research findings from a nationwide survey of lecturers in product design, seeking to gain an understanding of the state of the art in SPD.

Chapter 5 outlines empirical findings from semi-structured academic interviews, which sought to build upon the findings of chapter 4 and define best practise amongst the leading academics in the field.

Chapter 6 outlines the design and development of the main study, describing the intentions of the workshops and how they were implemented.

Chapter 7 presents the findings from the main case study at Limerick considering the students response to the ‘Rethinking Design’ workshops.

Chapter 8 presents the findings from the supporting case studies considering the students response to the ‘Rethinking Design’ workshops.

Chapter 9 presents a discussion of the findings from the three research stages by considering the outcomes in relation to the research questions.

Chapter 10 present the conclusions from the main study in relation to the research questions and outlines the contribution to knowledge arising from the research study. Further work that could be explored beyond the findings of this research study, including areas of interest that couldn’t be addressed within the time span available is also outlined.

References and Appendices are then presented at the end of the report.

Chapter 2. Literature Review

The literature review will consider a number of key areas relevant to the social aspects of sustainable product design (SPD) in Higher Education defining the boundaries of the social SPD as well as considering applicable educational criteria such as the learning preferences of designers complemented by a consideration of teaching and learning approaches that are beneficial to education for sustainability. The review considers existing literature on SPD education, in particular two doctoral studies and concludes by identifying a number of gaps to be addressed by further research.

Figure two below details the sections to be explored and the key subsections addressed within each of these.

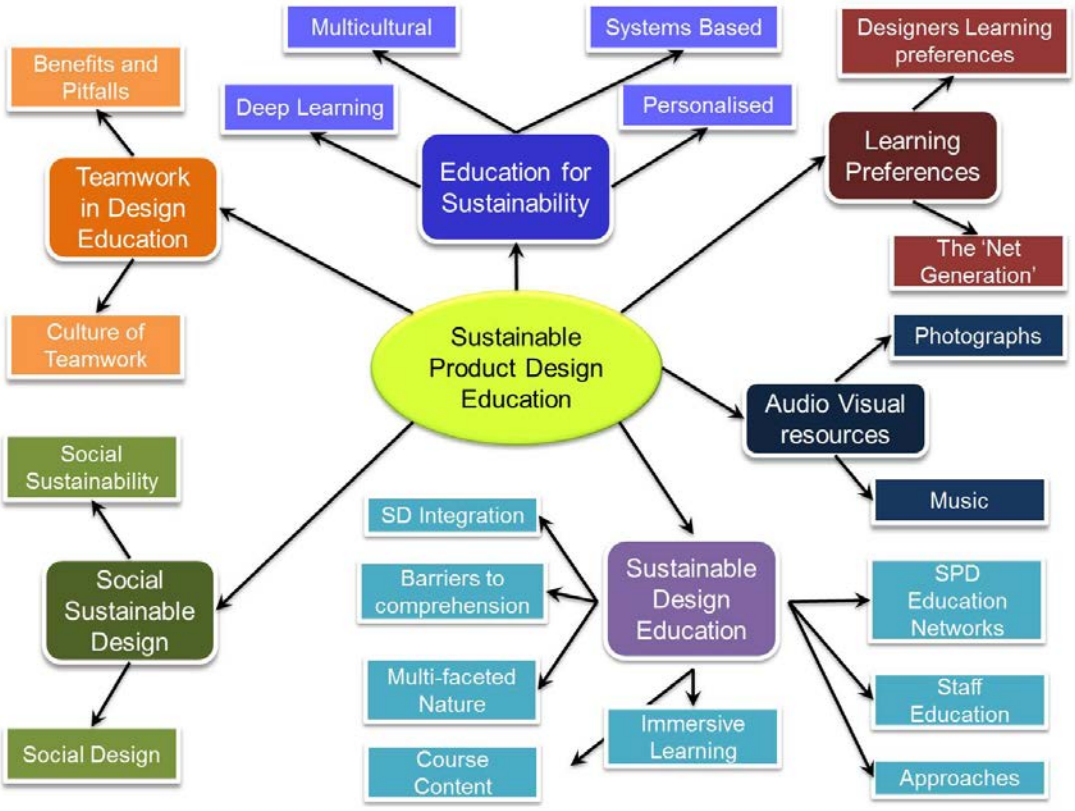


Figure 2 Literature Review Considerations

2.1. Education for Sustainability

Education for Sustainability is concerned with teaching to foster an understanding of sustainability in relation to the requirement for education for sustainable development, first recognised in the Agenda 21 (United Nations, 1992), leading to the current focus on the Decade of Education for Sustainable Development (United Nations, 2002). This chapter outlines literature findings relating to effective Education for Sustainability.

Wals and Jickling (2002) note that sustainability requires an interdisciplinary, systematic and holistic approach as the complex nature of sustainability cannot be conveyed by the traditional discipline based, linear and reductionist approach. McNerney and Davis (1996) note six core themes for Education for Sustainability, including:

- Systems Thinking
- Interdisciplinary Approach
- Partnerships
- Multicultural Perspectives
- Lifelong learning
- Empowerment

In addition this section considers collaboration, the personalisation of sustainability, critical reflection and deep learning as aspects identified in the literature as important to the understanding of sustainability. These core themes have been expanded upon in the following sections with the exception of partnerships and lifelong learning.

Partnerships, allude to partnerships between institutions and the wider community (McNerney and Davis, 1996, Cortese, 2003), and support many of the recommendations for sustainable education such as a real world view (Cortese, 2003) as well as incorporating a wider holistic approach (Cortese, 2003) required in education for sustainability. However the limitations of this research study didn't provide an opportunity for partnerships, but partnerships are an aspect of interest that the researcher is keen to engage

with in the future and for which there are numerous examples within the sustainable design education literature (Tomio et al., 2010).

While lifelong learning (Wals and Jickling, 2002) is a laudable goal is outside of the scope of this research study, which is concerned with developing effective teaching approaches. However it could be argued that lifelong learning could be viewed as a product of the ‘Sustainable Self’ approach described by Murray (2011) in section 2.1.3.

2.1.1. Systems Thinking Approach

A systems thinking approach is cited as an essential theme of education for sustainability (Warburton, 2003, McNerney and Davis, 1996, Li and Williams, 2006, Wals and Jickling, 2002, Cortese, 2003, Henry-Stone, 2010, Huckle and Sterling, 1997). It recognises that sustainability itself is a set of interrelated complex systems comprising of the ecological, social and economic systems and therefore sustainability education must be approached from a systems perspective recognising that all aspects of sustainability are interconnected and cannot be fully resolved individually (Wals and Jickling, 2002). Cortese (2003) notes that compartmentalised knowledge without a systems view results in narrow, ineffective solutions that can be more harmful than the problems they seek to address (Cortese, 2003). Kelly (2010) notes that the way sustainability issues are interpreted, taught and acted upon are determined by the lens through which they are viewed; agreeing with Wals and Jickling (2002) that a focus on reductionist thinking is inadequate when addressing the complexity of sustainability. Kelly (2010) describes how sustainability needs to be viewed differently through a complex systems thinking lens (Kelly, 2010). Complex systems (Henry-Stone, 2010, Kelly, 2010) are described as unpredictable interconnected systems, with nonlinear (Henry-Stone, 2010, Kelly, 2010) cause and effect relationships and fuzzy open boundaries that are difficult to determine (Kelly, 2010).

2.1.1.1. Interdisciplinary Approach

The nature of an interdisciplinary approach is considered to be central to the themes of sustainable development and sustainability education, requiring a radical shift from the traditional model of single disciplines to a more holistic interdisciplinary approach (Warburton, 2003, Huckle and Sterling, 1997, McNerney and Davis, 1996, Li and Williams, 2006), which recognises the interdisciplinary nature of the three pillars of sustainability (McNerney and Davis, 1996). Therefore an interdisciplinary approach is a crucial element of the systems thinking holistic nature of sustainability as noted above. However McNerney and Davis (1996) note that an interdisciplinary nature doesn't fit easily into the existing educational structure, which is discipline defined and orientated. Such a view is shared more widely within higher education due to the logistical and administrative issues (Raivio, 2011) that arise especially in undergraduate education, whilst multidisciplinary projects are more common within postgraduate courses (Denton, 1997).

2.1.2. Multicultural Perspectives

McNerney and Davis (1996) cite multicultural perspectives as a key theme of education for sustainability, suggesting that sustainability is dependent on an understanding of diverse cultural perspectives and approaches, whilst Li and Williams, (2006) use the term multiple perspectives to consider the views of the different stakeholders. Henry-Stone (2010) addresses place based education and the incorporation of learning from indigenous cultures and communities (Henry-Stone, 2010). Wals and Jickling (2002), note that sustainability requires an appreciation of and respect for diversity.

2.1.2.1. Collaboration

Whilst not strictly noted as a core aspect of education for sustainability, collaboration or group work is noted by many authors (Henry-Stone, 2010, Cortese, 2003, Wals and Jickling, 2002, Kelly, 2010, Warburton, 2003) as an important aspect of education for sustainability and could be considered a subset of interdisciplinary learning and partnerships. Collaborative learning, like interdisciplinary leaning and multicultural perspectives,

encourages the consideration of differing perspectives (Kelly, 2010), fostering a systems view and is cited by Kelly (2010) as an important aspect in supporting transformative learning.

2.1.3. Personalising Sustainability

Murray (2011) notes the need to personalise sustainability stating that in order to bring about sustainable change people need not only to understand sustainability but to connect with it at a personal level. Murray (2011) cites the following six educational stages necessary to personally identify with, and drive change in sustainability as shown in Figure 3.

Figure 3 The attributes for sustainable living

The two attributes, Awareness and Empowerment are explored in the following sections, with Motivation being considered as an aspect of deep leaning in section 2.1.5.1. It is understood that students first need to master these three stages so that they can apply their knowledge and skilful means within their practice.

2.1.3.1. Awareness

Murray (2011) notes how direct and indirect experiences can personally impact individuals and allow individuals to feel personally connected with the issue experienced, describing how carefully chosen images and words can

be used to cultivate such an indirect experience. To this end Murray (2011) uses carefully chosen photographs that depict human and environmental challenges that are synonymous with sustainability. A similar approach has been used to depict sustainability issues by photographic artists including Edward Burtynsky (Burtynsky, 2010) and the Hard Rain Project (Edwards, 2011). However Murray (2011) additionally asks individuals to respond to the images through carefully worded questions that seek to encourage reflection (Murray, 2011). Authors also describe the importance of context (Huckle and Sterling, 1997, Wals and Jickling, 2002, Kelly, 2010) in addressing sustainability and relating sustainability to contextual issues and situations that the student can relate to.

2.1.3.2. Empowerment

The need for empowerment of learners is noted by numerous authors (Wals and Jickling, 2002, Murray, 2011, Huckle and Sterling, 1997, Kelly, 2010) as a necessary aspect of education for sustainability. Huckle (1997) describes the need for education for sustainability to be process rather than product orientated, suggesting that such a focus requires an active and participatory approach, with an emphasis on active learning in contrast to passive teaching. The need for an active (Kelly, 2010, Wals and Jickling, 2002, Cortese, 2003, Warburton, 2003) and participatory (Warburton, 2003) approach is recognised by other authors, who also note the opportunities and benefits of collaborative learning (Kelly, 2010, Wals and Jickling, 2002, Warburton, 2003). In accordance with the need for empowerment of learning, Wals and Jickling (2002) note how education for sustainability requires the move from consumptive learning to a learner centred focus on learning by discovery (Warburton, 2003, Wals and Jickling, 2002), creative problem solving (Wals and Jickling, 2002) and experiential learning (Huckle and Sterling, 1997, Cortese, 2003, Henry-Stone, 2010, Wals and Jickling, 2002, Murray, 2011).

2.1.3.3. Critical Reflection

Huckle (1997) notes how education for sustainability needs to draw upon critical theory (Huckle and Sterling, 1997) and encourage learners to foster

critical reflection (Wals and Jickling, 2002, Kelly, 2010, Huckle and Sterling, 1997), critical thinking (McNerney and Davis, 1996, Huckle and Sterling, 1997) and the ability to critically discuss and review sustainability issues (Wals and Jickling, 2002).

2.1.4. Deep learning

Literature identifies the importance of deep learning in sustainable design education (O'Rafferty et al., 2008, Griffith and Bamford, 2007). Warburton (2003) suggests that deep learning is particularly relevant to education for sustainability, because of the interdisciplinary nature and holistic insight, but warns that the effectiveness of deep learning can be inhibited if the backgrounds of the students have a strong disciplinary focus (Warburton, 2003).

"Deep learning involves paying attention to underlying meaning. It is associated with the use of analytical skills, cross-referencing, imaginative reconstruction and independent thinking (Warburton, 2003)"

Numerous authors recognise the search to understand and extract meaning as a definitive trait of deep learning (Entwistle, 2000, Hounsell, 1997, McMahon, 2006, Warburton, 2003), whilst a passive memorisation and an intention to merely complete the task are characteristic of a surface learning approach (Entwistle, 2000, Hounsell, 1997, Vaughan, 2006, McMahon, 2006).

McMahon (2006) notes, that deep learning is more effective than surface learning because it leads to mastery in understanding that is necessary in a real world application. Whilst students may have a natural tendency towards either deep or surface learning, most students' decisions regarding their learning approach depend on external factors such as their experience in the classroom (Ramsden, 1997, McMahon, 2006) and their expectations of how the assessment (Marton and Säljö, 1997) will reward them (McMahon, 2006). This section will consider deep learning further in respect to SPD and

how deep learning as opposed to surface learning can be fostered in students.

Deep learning is dependent on how much a student engages with the topic (Marton and Säljö, 1997, McMahon, 2006) and deep approaches to learning are likely to arise from both good teaching and giving students more autonomy to choose both the content and ways of learning (Marton and Säljö, 1997, Vaughan, 2006, McMahon, 2006). Deep learning is found where students are motivated and engaged with the subject matter (Fransson, 1977, Marton and Säljö, 1997, Hounsell, 1997) Such students will tend to read beyond the course requirements (McMahon, 2006).

Conversely, surface learning is prevalent in students who perceive the learning as merely a way of addressing a study requirement (Marton and Säljö, 1997) and is commonly associated with students focussing on remembering facts (Hounsell, 1997) and opinions for repetition in assessment (McMahon, 2006). Inadequate prior knowledge, inadequate, insensitive teaching or an over-demanding syllabus, also encourage students to adopt a surface approach to learning as a coping mechanism (Hounsell, 1997, McMahon, 2006).

Fransson (1977) found that students who exhibited a strong interest, combined with low levels of anxiety, demonstrated a deeper approach to learning and were able to recall facts from a studied text well. Whilst students that lacked interest and felt threatened by the prospect of testing (McMahon, 2006), exhibited high anxiety and were likely to adopt approaches that demonstrated only surface levels of learning (Fransson, 1977). Describing approaches to assessment that could foster deep learning responses, McMahon (2006) suggests giving students greater ownership and choice (Vaughan, 2006, McMahon, 2006) over how and when they are assessed as well as ensuring that the assessment is designed to reward higher order critical thinking (McMahon, 2006). Describing such an approach McMahon notes the use of reflective diaries and short pieces of

writing that can be peer assessed, fostering the development of critical reflection through practise and feedback (McMahon, 2006).

Deep learning can be associated with an internal motivation (Warburton, 2003, Vaughan, 2006), whilst surface learning can be associated with an external requirement (McMahon, 2006, Vaughan, 2006, Entwistle, 2000). It is remarked however in the literature that this motivation isn't created by an individual but is instead found (Fransson, 1977, McMahon, 2006), so links between the learning material and what the students are interested in need to be made. This view is supported by Ramsden (1997) who asserts that course materials or assessment methods alone are not enough to ensure that students will think deeply about the subject matter and that it is necessary to consider the students' perspective. Furthermore noting Fransson's study Marton and Säljö (1997) state a deep approach to learning is best fostered in students by considering the students' own interests, whilst seeking to eliminate factors which cause students to adopt a surface approach; irrelevance, threat and anxiety (Marton and Säljö, 1997).

"*A deep approach, in the context of everyday studying, primarily refers to the realisation of the fact that the studies one is engaged in deal with some aspect of the "real world" and thus by studying, one is trying to improve one's understanding of it."* (Marton and Säljö, 1997)

McMahon (2006) describes how active (Entwistle, 2000) and collaborative learning can lead to deep learning by encouraging critical reflection (Vaughan, 2006, McMahon, 2006, Entwistle, 2000), further supporting a peer to peer and group based learning environment as described in chapters 2.2, 2.6 and alluded to in the academic interviews in chapter 5.

2.1.4.1. Student Motivation

It is necessary to ensure that the students are motivated in order to foster a greater likelihood of deep learning (Fransson, 1977, Marton and Säljö, 1997,

Hounsell, 1997) and Warburton (2003) notes the following considerations, which can affect motivation:

- Learning Environment
    - Scope for discovery and problem solving
    - Choice of study materials
    - Teaching style
    - Social context and cooperative learning
- Course Content
    - Key concepts and themes
    - Range/variety
    - Personal relevance
- Individual Factors
    - Metacognition
    - Prior knowledge
    - Experience
    - Personality
    - Morale
    - Workload

Most of the individual factors noted above relate to aspects that are out of the scope of the researcher's control such as the individual student's prior experience, prior knowledge, morale and personality. Therefore the focus of the research study can only consider how the taught content and delivery method can be best optimised for the most relevant and stimulating teaching of the social aspects of SPD. Section 2.2 will consider how the content and learning environment can be made relevant to the student's needs.

2.1.5. Conclusions

This section has highlighted numerous factors that encourage education for sustainability. It is clear that the systems nature of sustainability requires a different teaching and learning approach to enable students to grasp the complexity and uncertainty of sustainability. Coupled with this holistic and interdisciplinary nature, sustainability requires a non-traditional approach to

teaching and learning. Several recommendations are proposed including a focus on a learner centred and collaborative learning environment. The format of teaching should be carefully considered to ensure that it represents a contextual real world situation and represents a reality that students can relate to, even striving as Murray (2011) suggests to create an indirect experience through the careful use of images and words so that students can relate to the material and situations presented.

Furthermore the emphasis on active learning, critical reflection and learning by discovery are noted as key learner centred approaches that empower students. A number of these recommendations are also desirable in fostering a deep learning approach. Deep learning was identified as important to education for sustainability and SD, and the approaches cited to foster deep learning resonate with other strategies explored in this section including personal relevance to help students relate to sustainability issues personally.

Therefore a number of considerations can be taken forward from the literature concerning a curriculum design that is student centred, offers opportunities for autonomous learning, and motivates students by ensuring relevance as well as offering opportunities for collaboration and group work. Group work and learning preferences to promote deep learning will be explored further in this literature review whilst other elements will be addressed through the empirical research stages to inform the production of effective teaching resources for the main study.

2.2. Learning Preferences

This section will explore students' learning preferences, specifically building on the findings in section 2.1.4.1. This section will however consider the learning preferences from two angles, first those of designers as the research study is concerned with product design students and second the learning preferences of the current generation of students, known as 'Net Generation' learners.

2.2.1. Designers learning preferences

This section will briefly investigate how designers think, make decisions and solve problems through the design process. This area is a large field, but only a cursory overview will be given in this section to gain a basic understanding of the mind-set of a designer and help to guide the development of effective learning experiences for design students.

2.2.1.1. Thinking process

Lawson describes how a designer's thinking process is directed towards an end product and the communication of this product so others can realise their creation (Lawson, 2006). Markus (1969) cited in (Lawson, 2006) identifies four sources of information that are available to the designer to shape their decision making:

- Their own experience
- Others experience
- Existing research
- New research

Lawson (2006) suggests that these sources of information explain how designers can work in a random manner, seemingly jumping to conclusions at times whilst making slow progress at other times. Lawson (2006) describes how reasoning and imagining are the most important types of thinking to designers. A designer's reasoning is purposeful and directed towards an end goal, suiting the like-minded and task-driven attitude of a designer who must consciously direct their thought patterns toward the end product (Lawson, 2006). Imagining is described as a thinking process where an individual draws on their own experience combining material and information creatively in an unstructured way (Lawson, 2006).

2.2.1.2. Creativity

An aspect of imagining is the creative use of unstructured information that is directed towards an end goal. Citing Kneller (1965), Lawson (2006) notes

the five stages of such a creative process as depicted in figure 5.

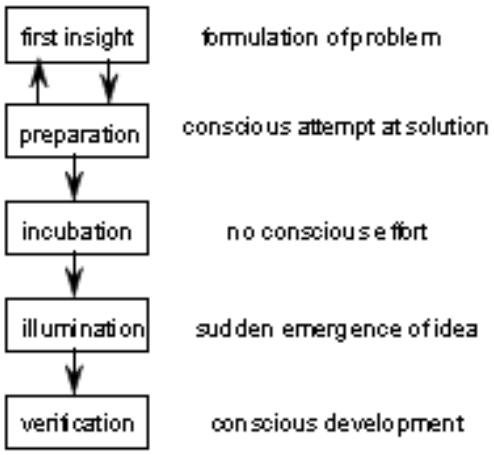


Figure 4 Five stage model of the creative process (Lawson, 2006:149)

First insight or the perception of a design problem or need is described as fundamental to initiating the process of creativity (Whitfield, 1975, Lawson, 2006). There is then an initial attempt at solving the problem followed by an incubation period, where a designer benefits from time and space away from a particular problem, permitting incubation of an idea in the designer's subconscious, (Whitfield, 1975, Glegg, 1969, Lawson, 2006). This respite is considered important as it allows time for the mind to restructure and review what has been absorbed during intensive research allowing for a 'Eureka' moment after some time. This 'incubation' period also allows the designer time and space to recognise unsuitable ideas and discard them.

2.2.1.3. Acquiring and using knowledge

Hertzberger (2001) and Laxton (1969) suggest that designers' creativity emerges from a reservoir of stored knowledge. Discussing design education, Laxton commented that children needed to accumulate a 'reservoir of knowledge' in order to be creative and likened the skills involved to those of hydro-electric power generation, introducing the principle of the reservoir of knowledge, from which information is drawn and ideas and principles generated, evaluated and then interpreted into a design form. This principle is illustrated in figure 6 (Laxton, 1969).

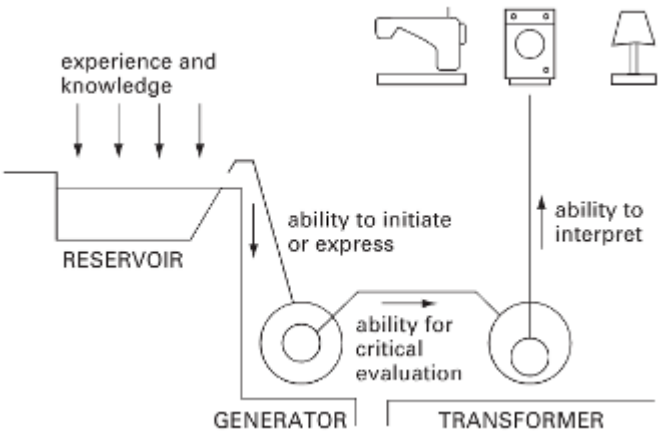


Figure 5 Laxton's hydro-electric model of design learning (Lawson, 2006:157)

The analogy given by Hertzberger (2001), proposes that the mind absorbs, registers and collates ideas in memory, creating a library that can be consulted when a problem arises.

Similarly Durling (1999) states that designers rely heavily on intuition, making decisions based on instinct rather than rational analysis and are therefore often happy to work with incomplete or uncertain knowledge, whilst intuitively working their way through a problem. This understanding fits well with Laxton's model suggesting designers are confident in their ability to utilise their personal library of knowledge and prior experiences to solve design problems. Therefore design educators need to consider how they can effectively foster opportunities for their students to absorb information in such a way that it can be processed and retrieved in this way at a later date when required.

2.2.2. The 'Net Generation'

Oblinger and Oblinger (2005a) define the 'Net Generation' as individuals born from 1982 onwards (Oblinger and Oblinger, 2005a, Howe and Strauss, 2003). This generation would have all typically been using computers by the time they were 16 to 18 years old (Oblinger and Oblinger, 2005a). However Oblinger and Oblinger (2005) note that the differentiating factor for the 'Net Generation' may be due to their technological experience rather than just their age. Whilst Tapscott (1998) defines the 'Net Generation as those born

after 1977, this generation born after 1982 are also referred to in the literature as the ‘Millennials’(Howe and Strauss, 2003, Holliday and Li, 2004) and ‘Digital Natives’ (Palfrey and Gasser, 2008). The Net Generation would typically apply to the vast majority if not all of the students involved in undergraduate and postgraduate study in the UK presently and therefore those subject to this research study. This also allows for mature students, as an individual born in 1982 would be 28 years old at the start of the main study trials, whilst traditional undergraduate students would be aged between 18 and 22 years.

Whilst the exact starting date of the Net Generation is disputed, all three authors agree that this generation require different forms of education to the generation that preceded them.

2.2.2.1. Educating the Net Generation

The Net Generation have differing learning styles and preferences to the generation that preceded them (Barnes et al., 2007) typically known as ‘Generation X’. This is partly due to the influence of computer technology, the internet and the social media upon their lives and also partly subject to the social climate (Tapscott, 2009) in which they are raised and their response to the attitudes of the previous generations (Howe and Strauss, 2003).

A number of authors have described educational approaches that are valued by the ‘Net Generation’ in Higher Education and these will be explored in the following sections:

2.2.2.1.1. Autonomous Learners

Net generation students prefer experiential (Barnes et al., 2007), learning by doing (McNeely, 2005) and place a greater emphasis on exploratory learning by discovery. Students prefer learning through discovery, whether individually or collaboratively with their peers, to the traditional lecture format where information is given to them (Oblinger and Oblinger, 2005b, Tapscott, 2009). Tapscott (1998) notes that this exploratory style improves students’

retention of information and allows for more creative and meaningful use of knowledge (Tapscott, 1998).

Oblinger and Oblinger (2005b) note that the Net generation are very achievement oriented and have a preference for structure, seeking parameters, rules, priorities, and procedures; they are keen to know what it will take to achieve a particular goal.

2.2.2.1.2. Social Learners

Net generation students are attracted to activities that promote and reinforce social interaction including interactive learning (Tapscott, 2009, Barnes et al., 2007), peer to peer learning (Oblinger and Oblinger, 2005b) and teamwork activities (Oblinger and Oblinger, 2005b, Tapscott, 2009, Barnes et al., 2007, Howe and Strauss, 2003).

This social nature of the Net generation means that they typically dislike online learning environments or distance learning, (McNeely, 2005) despite the technological focus because distance learning lacks the social interaction that a traditional learning environment offers. Tapscott (2009) notes benefits of this social approach describing how students start to internalise their learning when they start to discuss it amongst themselves (Tapscott, 2009). Oblinger and Oblinger (2005b) note that a peer-to-peer approach, where students help each other is seen by Net generation students as more credible than a teacher led approach.

2.2.2.1.3. Visual Learners

Net generation students are visual learners (Holliday and Li, 2004), with enhanced visuo-spatial skills (Tapscott, 2009, Oblinger and Oblinger, 2005b), who are more comfortable in image-rich environments than with text (Oblinger and Oblinger, 2005b, Windham, 2005, Tapscott, 2009). Net generation students retain on average 30% of what they see but only 10% of what they read and prefer to have graphics before text rather than graphics following text (Oblinger and Oblinger, 2005b). Oblinger and Oblinger (2005b) note that Net generation learners have a highly developed

visual literacy, with the ability to read images and instinctively communicate through visual methods. They are also capable of combining images, text and sound seamlessly (Oblinger and Oblinger, 2005b) and this is demonstrated by the prevalence of amateur You Tube content.

2.2.2.1.4. Immediate Multitasking Learners

Net generation learners seek and handle information differently to previous generations. They multitask (Barnes et al., 2007, Holliday and Li, 2004), quickly shifting their attention from one task to another and can work on two tasks simultaneously (Oblinger and Oblinger, 2005b) and deal with information in nonlinear ways (Oblinger and Oblinger, 2005b). Net generation learners respond more quickly than previous generations and expect rapid responses in return (Oblinger and Oblinger, 2005b). However it is suggested that this rapid pace may be detrimental to the student's ability to reflect and adopt critical thinking skills, which is cited as a weakness of the Net generation (Holliday and Li, 2004, Oblinger and Oblinger, 2005b).

2.2.2.1.5. Community focussed

Of particular interest to sustainability, it is noted that the Net generation are keen to engage in community activities, preferring to work on things that matter, such as addressing an environmental concern or a community problem (Oblinger and Oblinger, 2005b). Howe and Strauss (2003) similarly note that there is more emphasis on academic programs that serve public rather than individual interests (Howe and Strauss, 2003).

2.2.3. Conclusions

In conclusion this section exploring the learning preferences of the Net generation and characteristics of deep learning section 2.1.4 draws parallels with and supports a number of the key recommendations identified in education for sustainability in section 2.1 In particular the 'Net generation' preference for learning by discovery in contrast to the traditional consumptive teacher led learning approach is noted alongside collaborative learning as key characteristics of education for sustainability (Wals and Jickling, 2002).

A combination of the learning approaches and characteristics outlined in this section and the preceding chapters on education for sustainability and group work will be considered in the development of the main study teaching trials. Key considerations include the possible negative effect of assessment and the need for predominately visual media that fosters critical reflection and learning by discovery, whilst encouraging a collaborative group work environment.

2.3. Audio visual learning resources

Audio visual learning resources are referred to in multiple ways across different disciplines. In the computing and instructional education literature it often refers to web or IT based instructional programming, which is often used for distance learners, taking the form of online videos and pod casts as well as virtual learning environments to deliver distance learning effectively. However for the purposes of this study the author is only concerned with the use of audio visual resources in the physical classroom context. Such resources may use IT but will be delivered face to face and are used as an alternative or as an addition to traditional classroom based teaching and learning approaches. Therefore throughout the study when the term ‘audio visual’ is used it refers to the use of audio and visual content within a physical classroom environment with the intention of enhancing teaching and learning.

Audio visual (A/V) learning approaches are noted in the SD literature regarding the teaching of ethics and responsible practice to engineering (Perdan, Azapagic, & Clift, 2000) and design students (Griffith, & Bamford, 2007). However, very little detail is given on the development, choice for or intent behind such resources within these papers. Furthermore there is a lack of literature in the design field discussing the use or benefits of an A/V teaching approach. However the use of A/V teaching methods are well documented in the field of sociology education, where the practice of using both photographs and music is well established particularly in relation to teaching introductory sociology. This matches the focus of this PhD study

well, as it is concerned with developing an introductory approach for teaching the social aspects of sustainability within product design.

The reflective benefits of an A/V approach noted in the literature (Albers & Bach, 2003; Hanson, 2002; Tan & Pearce, 2011) addresses one of the perceived weaknesses of Net Generation learners (Holliday & Li, 2004; Oblinger & Oblinger, 2005). Whilst the careful use of visuals as noted in section 2.2.2.1.3 suits the visual nature and preferences of the Net Generation, the additional use of audio in a non-traditional form is noted in the literature as also being beneficial to learning (Ahlkvist, 2001; Albers & Bach, 2003; Brkich, 2012).

Using non-traditional A/V forms for teaching can help to encourage deep learning as described in section 2.1.4 in a number of ways. Adopting methods from popular culture can increase the relevance of the learning experience and thereby increase the student motivation, because the students are more able to relate to the content (Fransson, 1977; Hounsell, 1997; Marton & Säljö, 1997). The literature also describes the use of A/V methods to address theory in the curriculum that involves difficult concepts that can create anxiety for students (Hinds-Aldrich, 2012). Anxiety is noted as a key signifier for surface learning (Fransson, 1977), therefore targeting such teaching with alternative and relevant methods, which foster critical analysis and are related to the real world is more likely to ensure that deep learning is fostered in this context (Marton & Säljö, 1997). Furthermore the use of A/V approaches can foster critical thinking and reflection by encouraging discussion in a group context through the creation of a shared experience (Albers & Bach, 2003; Hanson, 2002; Hraba, Powers, Woodman, & Miller, 1980).

2.3.1. Auditory stimuli through the use of popular music

The use of popular music is specifically noted in literature (Ahlkvist, 2001; Albers & Bach, 2003; Brkich, 2012; Crowther, 2012; Last, 2009; Martinez, 1994, 1995) as a non-traditional method for teaching that is used with undergraduate students to foster reflexive, relevant and effective

introductions to topics across multiple disciplines (Albers & Bach, 2003; Last, 2009; Martinez, 1995). The use of music is described as a means to draw common ground and relevance with students (Albers & Bach, 2003; Martinez, 1995) and is noted as being a popular and effective learning device amongst students (Ahlkvist, 2001; Albers & Bach, 2003; Martinez, 1995). Albers and Bach (2003) describe how popular music can be used to link the student's real world experience with the focus of their study as well as exposing students to cultures and experiences beyond their own (Albers & Bach, 2003; Brkich, 2012). This echoes Murray's (2011) writings on the creation of an indirect experience through the use of carefully selected photographic images. Whilst Crowther (2012) additionally explains how music can evoke strong emotions that can enhance aspects of memory.

Albers and Bach (2003) also note that the use of popular music can overcome gaps in individual students' cultural knowledge, suggesting that the use of music is suited for introducing complex (Ahlkvist, 2001; Albers & Bach, 2003) and controversial (Brkich, 2012) topics. Authors also describe how the use of music at the start of a lecture makes students more comfortable and at ease (Albers & Bach, 2003; Crowther, 2012) and fosters a greater level of discussion with their peers and staff (Ahlkvist, 2001; Albers & Bach, 2003; Martinez, 1995) due to the creation of a less formal and more inclusive environment (Albers & Bach, 2003). This enables a participatory learning environment where students can exercise peer learning and mutually explore the meaning and knowledge (Ahlkvist, 2001; Albers & Bach, 2003; Brkich, 2012), making connections by considering why a particular musical selection was made in relation to the topic (Albers & Bach, 2003). Such discussion encourages the development of a shared understanding between individuals and encourages critical reflection (Albers & Bach, 2003; Martinez, 1995).

Albers and Bach (2003) findings noted that when a piece of music related to the subject content, was played within the first 5 – 10 minutes of the lecture the students found that it encouraged them to start thinking about the topic

enhancing concentration and interaction in the lecture (Albers & Bach, 2003).

2.3.2. Visual stimuli through the use of photographs

As explored in earlier sections of the literature review, which highlight the importance of a visual approach. The benefits of a visual approach are multifaceted, the use of photographs can facilitate an indirect experience, which helps students to personalise aspects of sustainability (Murray, 2011) and the use of visual methods suit the learning preferences of Net Generation learners (Holliday & Li, 2004; Oblinger & Oblinger, 2005; Tapscott, 2009; Windham, 2005), giving rise to an increase in motivation and leading to a higher likelihood that deep learning may take place.

The use of visual sources and studies of photographs is widely noted in respect to understanding social realities and history within the field of sociology education (Hanson, 2002; Harper, 1988; Hraba et al., 1980; Schell, Ferguson, Hamoline, Shea, & Thomas-Maclean, 2009; Wagner, 2002) as well as more recently in sustainability (Burtynsky, 2010; Murray, 2011).

Perkins (1994) claims that the very act of looking at visual artefacts needs to be ‘thought through’ and that this act of thoughtful looking will help students to think better (Perkins, 1994). Perkins (1994) describes how a photograph needs interpretation; therefore the visual cues of the photograph can be read to deduce the intended or interpreted meaning. Hanson (2002) citing Perkins (1994) emphasises the requirement for adequate time to encourage such processing and investigation of an image by students (Hanson, 2002). Hanson describes this in practice by showing students 26 photographic images taken during the US great depression and then asked students to focus on a single image accompanied by 5 questions to guide them through the interpretation that took the students 10 minutes to complete. Hanson (2002) found that encouraging reflection in this manner greatly increased the length and participation in the class discussion that followed and notes

that this time and the space to reflect through note taking or small group discussion is an important aspect (Hanson, 2002).

The use of photographs to support students learning is reported to be a powerful learning tool (Schell et al., 2009) that can stimulate discussion and increase participation (Hanson, 2002; Schell et al., 2009) and is positively received by students (Hanson, 2002; Schell et al., 2009).

2.3.3. Audio Visual – Combining approaches

References to the combining of auditory stimuli (music) and visual stimuli are made in the sociology literature by Ahlkvist (2001) who decribes the use of music visuals, Hraba et al. (1980) who cite both the use of photographs and music to portray social change and Tan and Pearce (2011) who use selected YouTube videos to support theory. Hraba et al. (1980) describe how photographs and music can communicate the subjective side of social change in their teaching, illuminating the topic and providing experiential learning for students. Their findings suggest that the students react well noting the 'real' nature of the class and an appreciation of how the music helps the students to verify the traditional lecture content (Hraba et al., 1980). Tan and Pearce (2011) found that the use of the Youtube videos was beneficial in inititating class discussion, through the use of questions that were displayed during the videos, fostering critical analysis and deeper learning (Tan & Pearce, 2011). Tan and Pearce (2011) found that students had a largely positive response to the videos, appreciating the short length and non traditional format and the ability to view as a group, describing how the students found that the use of Youtube videos was validated by the fact the lecturer had selected the videos. (Tan & Pearce, 2011).

A combined approach of using music and photographs has also been used more recently for the sustainability agenda. The 'Hard Rain project' uses Bob Dylan's song "A Hard Rain's A-Gonna Fall" to accompany images taken by the photographer Mark Evans (Edwards, 2011) to communicate issues concerning the human and enviromental dimension of sustainble development.

Crowther (2012) describes how music can be combined with visual material or movement to create multimodal learning experiences that address more than one form of learning style (Crowther, 2012). Moreno and Mayer (2000), agree describing how the use of complimentary stimuli such as the use of both audio and visual can enhance the learning experience citing Park and Hannafin (1993) and their 7th principle which states that:

"Learning improves as the number of complimentary stimuli used to represent learning content increases" (Park & Hannafin, 1993:p72)

However Moreno and Mayer (2000) caution that the use of additional forms of media should be complimentary and relevant to the taught content, as additional auditory stimuli can be detrimental to learning if it is not directly related to the visual or textual form of learning (Moreno & Mayer, 2000). Hraba et al. (1980) also describe how music should be carefully selected to ensure authenticity, noting that audiences tend to be surprisingly sensitive to the inclusion of inappropriate music selections (Hraba et al., 1980).

2.3.4. Conclusions

The literature supports the use of non-traditional A/V techniques in addressing complex aspects of social theory; in particular the use of contemporary music is well supported in this literature. The benefits of using such approaches in relation to the earlier literature findings on the Net Generation and Deep Learning are evident. Through the use of appropriate methods for encouraging relevance and motivation as well as matching the particular learning preferences and styles of the current cohort of students. Additional benefits include encouraging discussion and critical thinking as well as the popularity of such an approach amongst students. However it is clear that in combining the audio and visual elements care needs to be taken to ensure that the two approaches are complimentary and the social message is reinforced rather than diluted. Additionally students need to be encouraged to be thoughtful (Perkins, 1994) and therefore adequate time needs to be given to permit visual processing (Hanson, 2002).

Whilst the literature supported numerous approaches to the inclusion of non-traditional A/V including music or photographs, as an individual or combined medium, or open educational videos such as found on YouTube, the researcher finds the case for the use of photographs and complimentary contemporary music to be the most compelling. Because such a multimodal approach reinforces the subject and learning experience as well as suiting differing learning preferences of students. Whilst a YouTube style approach (Tan & Pearce, 2011) is more contemporary the researcher feels that it could be perceived as lacking academic credibility and prefers the creative flexibility and ease of repeatability that the use of still photography and music would offer.

2.4. Sustainable product design education

A review of literature on the state of SPD education revealed a number of studies ranging from the development of individual resources to a complete worldwide survey on the state of sustainability within product and industrial design education (Humphies-Smith, 2007, Lofthouse, 2009, Trimingham et al., 2008, Ramirez, 2006, Griffith and Bamford, 2007, Richardson et al., 2005). Different institutions deal with the subject of sustainability in different ways from distinctive sustainable design degree titles to specialised modules on existing courses or taught content within an existing module. This content can also vary dependant on the understanding of sustainable design. Some institutions will cover only the environmental considerations whilst others will consider all three areas encompassed by sustainable design.

2.4.1. Sustainable design education networks

Literature suggests that a culture of networking amongst different institutions at a local or global level could be beneficial in improving the level of teaching sustainability in product design (Vezzoli, 2003). This culture of sharing knowledge and resources through a network is evident at a national level in both Italy (Vezzoli, 2003) and Wales (O'Rafferty et al., 2008).

A number of other institutions have individually produced freely available educational resources for ecodesign and sustainable design. These include:

- Okala: a modular ecological design resource produced by the IDSA specifically for use in higher education in the United States (Griffith and Bamford, 2007, White et al., 2005).
- Greenfly: a simplified LCA resource based upon Australian data and produced by the Centre for Design at the Royal Melbourne Institute of Technology (RMIT) (Ramirez, 2006, Centre for Design at RMIT, 1997).
- Ecodesign materials specifically produced for developing countries such as Central America by Delft University of Technology (Diehl et al., 2001)
- Toolbox for sustainable design education produced by Loughborough University (Bhamra and Lofthouse, 2004).

However these resources will not be explored further as all of the above resources focus solely on Ecodesign addressing the environmental and economic aspects of SPD and not the social aspects which are the focus of this research study.

With the exception of the documented partnership between all four of the Welsh universities (O'Rafferty et al., 2008) much of the literature from the UK suggests that universities typically take an individualistic approach to the implementation of sustainability within industrial and product design courses, with each university reporting on their different approaches to the integration of sustainable design (Tudor, 2009). No literature was found to give a holistic state of the art review of sustainable product design education in the UK.

2.4.2. Staff education

A scoping report for the Design Council found that design educators are challenged by the broad skill set required to practise sustainable design (Richardson et al., 2005). A report by the Higher Education Academy found

that a key barrier in implementing sustainability in higher education was a limit in awareness and expertise amongst educators (Dawe et al., 2005). Ramirez (2007) found that the majority of academics teaching sustainable design were either self-taught or educated by attending seminars, conferences and symposia. However pockets of expertise do exist in specialist research groups and centres.

2.4.3. Approaches to sustainable design education

In a worldwide study of sustainability education for industrial and product designers Ramirez (2007) found that sustainable design teaching was primarily delivered in one of four ways:

- Through a generic non design module option on the environment or sustainability, delivered in another department of the university. These generic modules offered a broad approach to environmental and sustainable issues but didn't provide specific teaching on planning for products or services. The use of such an approach possibly indicates a lack of training amongst the design staff involved.
- Through lectures on sustainability within the existing design theory or methodology courses but without any design activity.
- Through a dedicated 'green design' studio course where students were expected to generate design solutions within the context of traditional ID education.
- Through at least one studio project, which students use to demonstrate their sustainability understanding.

Documenting the experiences of teaching sustainability in the New South Wales University, Griffith and Bamford (2007) state how sustainability was integrated into the course through three modules:

- Design and the environment, considering both natural and manufactured resources.
- Design methods, concerning responsibility and practice

- Design, concerning philosophy, ecology and culture (Griffith and Bamford, 2007)

Each module featured weekly lectures followed up by tutorials with group exercises, including simulation exercises, debates, team building exercises and project presentations. Other activities used to promote awareness and support learning were audio-visual presentations scheduled prior to lectures, field trips and the showing of documentary films (Griffith and Bamford, 2007).

Within the above teaching approaches there are differing considerations such as whether an applied or holistic approach to SPD is taken and how much freedom is given within project briefs and assessment. These will be explored in the following subsections.

2.4.3.1. Applied or Holistic approaches to SPD

Two distinct approaches to the teaching of sustainability in design have been observed from the literature. Fletcher and Dewberry allude to these two distinct approaches as possible starting points as to whether sustainability is considered within the usual context of design or whether design is considered within the wider context of sustainability as demonstrated in Figure 6 (Fletcher and Dewberry, 2002). These distinct approaches will be referred to throughout the rest of the study respectively as, an applied or a holistic approach to sustainable design. Distinguishing between addressing sustainability within design (a reductionist approach) or relating to design as an aspect within the wider sphere of sustainability.

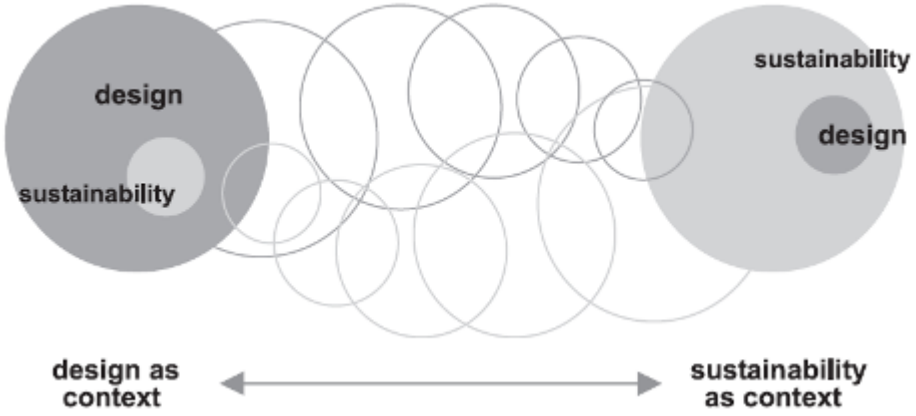


Figure 6 Range of possible starting points for education in design for sustainability (Fletcher and Dewberry, 2002)

Cull (2005) also recognised distinctions in the way that students approach sustainable design referring to the 'tangible aspects' and 'intangible aspects' of sustainability, recognising the 'tangible aspects' of sustainable design as the key environmental and lifecycle considerations and intangible aspects of sustainable design, as user orientated aspects such as behaviour change (Cull, 2005). Clunes (2009) also recognised that students lack confidence in addressing the socially orientated aspects of design for behaviour change and noted that ecodesign solutions are far easier to quantify (Clunes, 2009)

One of the key findings by the Higher Education Academy in a report (Dawe et al., 2005) concerning sustainable design education supported a holistic thinking approach towards sustainability (Dawe et al., 2005) and the complex system approach described in section 2.1.1.

2.4.3.2. Nature of the brief and Project Outcome

Shepherd et al., (2007) discusses how sustainability can be addressed in the students' projects through either fixed or open briefs or fixed or open outcomes. Shepherd et al. examined four combinations of open and fixed briefs and open and fixed outcomes in projects relating to sustainability. It was discovered that fixed briefs and fixed outcomes were too conformist and students also largely reverted to environmental based solutions (Shepherd et al., 2007).

It was however found that an open brief and open outcome would leave the students feeling vulnerable and typically lead to predictable and safe outcomes that also only address tangible environmental issues, because students found the freedom of an open brief and outcome too much of a risk and so reverted to what they can easily understand and grasp (Shepherd et al., 2007). This reverting to the tangible aspects of sustainability is in agreement with Cull's research (Cull, 2005). Shepherd's (2007) research would therefore suggest that the best combination utilises either a fixed brief or outcome to foster creativity and greater opportunity amongst students to address the intangible social aspects of SPD.

2.4.4. Immersive Learning

Both Wilgeroth (2008) and Gürel (2010) cite immersive approaches to learning in sustainable design education. Wilgeroth (2008) cites the effectiveness of an immersive environment in normalising student preconceptions, especially international students who may have different social and cultural expectations. Wilgeroth (2008) notes that empathy can be a powerful influence on designers and that immersive learning can foster a holistic outlook that is required to encourage attitudinal changes in students when considering sustainability issues (Wilgeroth et al., 2008).

Both Wilgeroth (2008) and Gürel (2010) cite field trips designed to immerse the students in an environment that encourage them to consider aspects of sustainability relating to their projects. Gürel (2010) took final year undergraduate interior architecture students on two field trips. The first was an exemplar energy efficient government building. The second featured a project site where students were able to experience an old building that they intended to revitalise and were given an interactive lecture on the building's industrial heritage. This gave the building meaning as well as illustrating to students the social-political importance of the site and the potential of sustaining a communal memory (Gürel, 2010). In order to reinforce the effects of an immersive environment the design studio itself was also declared a 'sustainable environment' based on the belief that behaviour reflects values held (Gürel, 2010).

Wilgeroth (2008) documents the experience of a residential visit as part of a sustainability module on an MSc Product Design program at the Centre for Alternative Technologies. Here students stay in specially designed accommodation to learn about sustainable living and the consequences of their behaviour in respect to the use of a limited electricity supply and having to collect fire wood for heating (Wilgeroth et al., 2008).

2.4.5. Course Content

Literature has revealed inconsistencies in the use of the term ‘Sustainable Product Design’ or ‘Sustainable Design’ in relation to education, with many references citing only the environmental and economic considerations of ecodesign (Humphies-Smith, 2007). This view is supported by Ramirez (2007) who found that most participants in the worldwide survey interpreted sustainable design as being identical to ecodesign or green design, not considering the social and ethical aspects of sustainable design. Whilst Griffiths and O’Rafferty (2010) note that SPD education emphasises environmental impact over social considerations (Griffiths and O'Rafferty, 2010).

Student projects also appeared to focus predominantly on environmental issues (Cull, 2005, Ramirez, 2007b, Ramirez, 2007c, Ramirez, 2006) with the most popular themes being selection of environmentally preferable materials, designing for recycled or recyclable materials and design for disassembly and recyclability, followed by life cycle analysis, product life extension, and efficient use of energy, water and fuel. However where student projects were found to be addressing the true nature of sustainable design, issues such as design for community needs, regenerative design, inclusive design, service design and social equity projects were addressed (Griffith and Bamford, 2007).

Park (2010) describes how different approaches are required in the teaching of sustainable design to address a balance that best supports students achieving ‘literacy’ in sustainable design. Park (2010) suggests that a combined approach of theory and studio practice should be used, with the

focus changing throughout the education levels, building up introductory knowledge early in the program and becoming more specialist in the final year, suggesting that design tools and strategies are best placed in the middle level of a course (Park, 2010).

2.4.5.1. Use of Design Tools

Park (2010) above notes the use of design tools and strategies suggesting that these are best used in the middle of a course of study. The use of design tools are mentioned elsewhere in the SPD literature. In a survey of Australian universities Ramirez (2006) found the most popular ecodesign tools used by students were environmental impact scenarios, ecodesign checklists and simplified lifecycle analysis (LCA), whilst the more complex LCA packages such as such as Sima Pro and material intensity per service unit were less popular.

Lofthouse (2009) and Vezzoli (2003) also reference the use of tools within a sustainable design curriculum at Loughborough university in the UK and Politecnico di Milano University in Italy (Lofthouse, 2009, Vezzoli, 2003). Both authors cite visual tools such as the Ecodesign Web and Design Abacus, LiDs wheel (Eco.officina), web based resources containing case studies Information Inspiration and Eco Cathedra and simplified LCA tool Eco-Indicator 99 and Eco.officina.

However of these tools mentioned all but one are strictly ecodesign tools relating only to the environmental aspects of SPD and don't consider the social aspects of SPD, which is the focus of this research study. Furthermore there appears to be disagreement on the appropriateness of tools to support sustainable design education, with other sustainable design educators critical of an tool based approach and its reductionist impact on creativity (Chapman, 2005, Millet et al., 2007). A review of such tools will therefore not be given in this thesis but a full exploration of the tools and strategies can be found in Appendix B.

2.4.6. Addressing the Multifaceted Nature of SPD

Examples of students' concepts produced in Cull's (2005) study showed that not only did students only consider the environmental aspects of sustainable design but that the majority of students only dealt with single issues such as dematerialisation, reusability and EOL as shown by examples in figures 7 & 8. This suggests that the students didn't grasp the multifaceted nature of sustainability. This focus on single issues isn't explored in Cull's (2005) thesis but could be attributed to the students' interpretation of the approach used in their instruction.

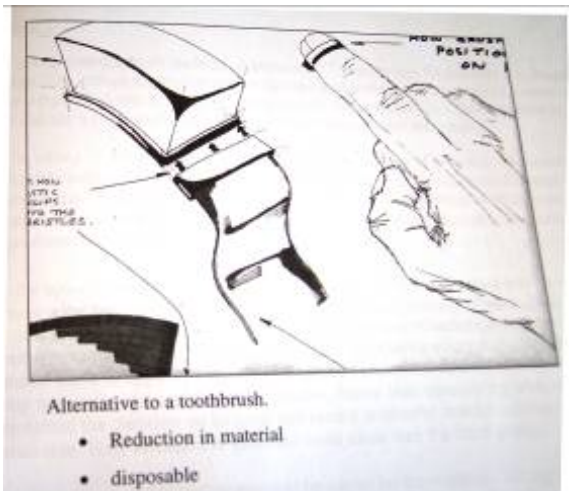


Figure 7 Student Sustainable Concept (Cull, 2005)

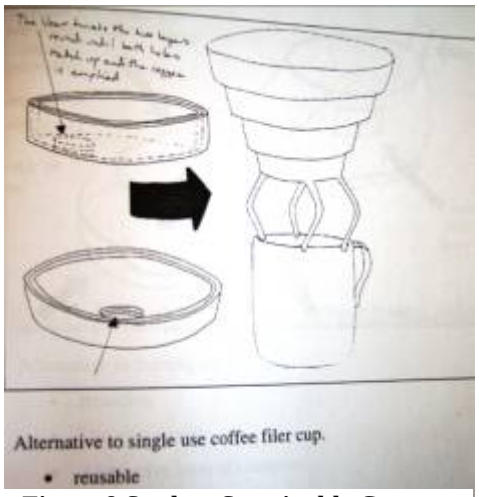


Figure 8 Student Sustainable Concept (Cull, 2005)

Loughborough University uses design tools with their students to encourage students to consider a wide variety of sustainable design issues. For example the ecodesign web (Lofthouse, 2009), which encourages students to assess their designs in terms of seven aspects of ecodesign, including materials usage, materials selection, product usage, optimal life, end of life considerations, distribution and new ways of doing it (Bhamra and Lofthouse, 2007). This approach encourages students to consider a variety of issues, redressing the single issue mentality. However Chapman (2005) criticises such a prescriptive approach to sustainable design, as restricting creativity and discouraging holistic thinking.

"The well intentioned call of sustainable design is somewhat prescriptive, whereas people – especially design people – do not like being told what to

do. It therefore appears clear that imposing the rigid principles of sustainability upon the creative professions in a top down approach will only serve to stunt creativity by threatening the 'blue sky ideology' that creative practitioners hold so dear. It is vital that we revisit the methods through which we discuss sustainability, and the way in which it is shared, discussed and implemented within creative practice. (Chapman, 2005)."

Both Cull (2005) and Collado-Ruiz and Ostad-Ahmad-Ghorabi (2010) also share this view, both finding that considering environmental information can stunt creativity in concept generation. Collado-Ruiz and Ostad-Ahmad-Ghorabi (2010) describe a fixation effect, whilst Cull (2005) found that the tangible aspects such as end of life (EOL) considerations constrained the students' creativity in the concept generation stages, but that the more socially orientated intangible aspects such as behaviour change didn't constrain the design (Cull, 2005).

Similar to Cull's (2005) findings Clunes (2009) discovered that students in the first iteration of his study reverted predominately to what he described as 'Techno-fix' solutions seeking to improve the environmental impact through the use of technology rather than behaviour. Clunes (2009) describes fostering deep learning in the 3rd iteration of his study enabled this to be addressed and result in a higher incidence of user behaviour and system based solutions (Clunes, 2009).

2.4.7. Barriers to student comprehension

It was found that students who had attended theory or methodology courses covering sustainable content still lacked references to sustainability in their projects (Ramirez, 2007b). Ramirez (2007b) referred to this as the student 'box' mentality where students consider different courses in the curriculum as different 'learning packages'. This attitude requires the lecturer to attempt to demonstrate the interconnectedness of the various subjects (Griffith and Bamford, 2007) and would appear to support the argument for the integration of sustainable design into the core product design curriculum.

Observing students' application of sustainable design in the concept generation phase, Cull (2005) found that the students readily addressed tangible aspects such as EOL considerations, but found that they were constrained by the prescriptive nature of such consideration. In contrast the intangible aspects such as behaviour change didn't constrain the design but were much harder to address and were therefore typically avoided by students (Cull, 2005). Cull notes in the analysis of these studies that the SPD learning demonstrated by the students could have been only 'surface learning' (Cull, 2005).

2.4.8. Sustainable design integration

The debate concerning whether to integrate sustainability into the mainstream design curriculum or deliver sustainability through separate modules centres around conflicts such as:

- What constitutes good design education?
- The role of higher education in society
- Potential politicisation of students
- The skills and competencies available within universities.

(O'Rafferty et al., 2008)

Park (2010) noted that the barriers to sustainable design education included an overcrowded curriculum, irrelevance, limited staff awareness and expertise and limited commitment from the institutions. However the worldwide survey of product and industrial design education conducted by Ramirez (2007) revealed that over half of the respondents' courses addressed sustainable design as a compulsory or core subject in their curriculum. A further 37% stated that their courses contained optional courses in sustainable design (Griffith and Bamford, 2007), whilst a prior Australian survey conducted by Ramirez (2006) revealed that over 90% of respondents agreed that sustainability should be integrated in all industrial design curricula in Australia within five years. Park (2010) and Gürel (2010) support an integrated approach to sustainable design, weaving sustainability into design theory and design studios as the most acceptable method of

introducing sustainability in the design curriculum as it negates the need to remove aspects from the curriculum. Furthermore Park (2010) notes that core principles of sustainability content can be incorporated into teaching that already exists in the design curriculum through human factors, and service design.

2.4.9. Conclusions

A number of inconsistencies in the use of the term ‘Sustainable Design’ are noted in the literature, with some authors reverting to only the environmental considerations, outlined earlier in this thesis as ecodesign. This sole focus on ecodesign was evident from both an academic and student perspective in sections of the literature and was also attributable to design tools and strategies used in SPD education which focus solely on the environmental parameters.

It was also suggested that students find the environmental aspects easier to address and both Shepherd (2007) and Cull (2005) describe addressing the environmental aspects as student fall-back positions. Environmental considerations are typically described as tangible aspects, whilst the social concerns in SPD the focus of this research study are described as intangible. Furthermore it was found that the open or fixed nature of both briefs and outcomes in project work affected students’ tendencies to revert to only addressing environmental considerations. Therefore a key focus of this research study is to foster methods by which students will feel confident in addressing the social aspects of SPD.

Cull (2005) noted that students had difficulty in grasping the multifaceted nature of sustainability, addressing either single issues or predominately environmental issues and negating the social implications. This may have been due to the particular teaching methods employed, but will form a consideration of the research study to enable students to recognise the interrelated nature of numerous SPD issues. Additionally it was noted that students often compartmentalise sustainability as a specialism, demonstrating an inability to integrate sustainability throughout their

practise. This could be due again to the teaching method employed, as different methods were cited for teaching SD including theoretical modules, specific projects or studio practice. However there was general agreement within the literature that sustainability should be integrated into the product design curriculum.

SPD education can be explored from either a holistic or applied approach, with an emphasis on more holistic approaches fostering aspects such as immersive learning, whilst applied methods centre on tools and strategies. In order to consider the social aspects of sustainability it is anticipated that in light of the findings around the nature of fixed or open briefs and outcomes this study would seek to focus on a holistic approach that fosters greater opportunity for consideration of the social aspects of SPD.

This chapter highlights a number of findings from various sources, however much of the information available on the inclusion of sustainability within product design courses is related to worldwide or Australian data. Similarly much of the literature related to SPD was derived from individual institutions, so whilst this section is informative its scope is perhaps narrow in some aspects and too generic in others. However the findings will be used as an outline for further research within on UK universities and courses.

2.5. Social Sustainability and Social Design

Whilst sustainable design education has emphasised and made inroads into addressing the environmental aspects and impact related to products and services, it has neglected the social considerations, particularly social wellbeing (Griffiths and O'Rafferty, 2010).

The range of literature available that discusses the social design requirements in SPD is limited. Two texts in the field address the issue but only give an outline of social issues of SPD (Bhamra and Lofthouse, 2007, Tischner and Charter, 2001). Bhamra and Lofthouse (2007) noted the following social issues related to SPD; usability, social responsible use,

sourcing and designing to meet human needs including ergonomics, inclusive design, design for the aged and design against crime (Bhamra and Lofthouse, 2007), whilst Tischner and Charter (2001) provide quite a generic list of social issues, as illustrated in figure 9.

Economic Issues	Environmental Issues	Social/ethical issues
► Technological feasibility	► Waste minimisation	► Fair trade
► Financially feasibility	► Cleaner manufacturing	► Equitable policies
► Short- and long-term profitability	► Cleaner materials	► 'Good' employment
► Adequate pricing	► Eco-efficiency	► Conditions of work
	► Less materials	► Investment in communities
	► Less energy	► Support for regional economy
	► Renewable resources	► Cruelty-free
	► Renewable energy	► Satisfaction of real needs
	► Recycling	► More customer value
		► Better systems
		► Participation
		► Equality (gender)

Figure 9 Typical SPD concerns (Tischner and Charter, 2001)

However the existing doctoral studies in SPD educational literature (Cull, 2005, Clunes, 2009) that underpin the focus of this research study appear not to support these social aspects in action. Cull (2005) describes a number of social and aesthetic influences as intangible aspects including biomimicary, product scripts (which is considered an aspect of emotionally durable design) (Chapman, 2005) and affordability. Clunes (2009) refers solely to changes in human behaviour in respect to social considerations therefore referring only to user behaviour change. Such limited findings in the literature correspond with findings by Vezzoli (2006) who calls the social-ethical dimension of sustainable design a new research frontier, describing the field as relatively unexplored, with a lack of teaching proposals.

In response to this a wider literature review has been conducted addressing social sustainability generically across other disciplines outside of design and this will be considered alongside literature defining social design and is

expanded upon in the following sections. The outcome of this section will then be combined with findings from the later empirical research.

2.5.1. Social Sustainability

Sustainability as described by the triple bottom line considers the three aspects of sustainability: the economic, environmental and social concerns, considering all three aspects to be of equal value(Elkington, 1998). However, literature suggests that the social concerns are typically regarded and considered to a lesser extent than the economic and environmental concerns (McKenzie, 2004, Littig and Grießler, 2005, Colantonio and Dixon, 2009). It is also noted that where users are considered in relation to sustainable design it is too often to address their impact on the environment, rather than wider societal needs (Page and Stewart, 2007). Social sustainability is far more difficult to quantify than economic growth or environmental impact and therefore it is often the most neglected element of the triple bottom line (McKenzie, 2004, Colantonio and Dixon, 2009).

In addition to the three pillars of sustainability, a number of authors describe the need for a fourth pillar that addresses culture (Hawkes, 2001, Nurse, 2006), cultural-aesthetic (Littig and Grießler, 2005) or political-institutional (Littig and Grießler, 2005, Kumar, 2008) issues. However such issues are disputed by Walker (2010) who argues that many of these issues can be incorporated as social issues under the triple bottom line. Instead Walker (2010) recognises spirituality (Littig and Grießler, 2005, Walker, 2009, Walker, 2010b) as a potential fourth pillar but concludes that such a term could be unacceptable to some, alternatively proposing personal meaning as the fourth pillar of sustainability, suggesting that such a term acknowledges the individual nature of individuals and their desire to seek for meaning (Walker, 2010b).

In order to pursue social sustainability McKenzie (2004) argues that it must first be defined as distinct from environmental or economic sustainability so that best practise models can be developed, before attempting to measure its effect on the environmental parameters. Whilst Littig and Grießler (2005),

exploring the link between environmental and social sustainability, comment that sustainability is drawn from a need to understand the social processes that concern how society interacts with nature (Littig and Grießler, 2005) as well as the internal problems such as social justice, gender, equality and political participation (Becker and Jahn, 1999).

The rest of this section will focus solely on social sustainability as a separate entity from the rest of the triple bottom line as McKenzie (2004) suggests, in order to highlight the issues that are currently unaddressed, but will still consider areas where direct cross-over occurs as highlighted (Littig and Grießler, 2005) above, as social sustainability cannot be fully separated from the environmental or economic constraints (Murray, 2011, Walker, 2009, Chick and Micklethwaite, 2011). There are notions of conflicts due to the interrelated complexity of sustainability, with the need to serve society's needs, whilst still protecting the environment for current and future generations (Murray, 2011, Fuad-Luke, 2009). This is particularly difficult where people's livelihoods rely on practises that are deemed un-ecological such as deforestation (Murray, 2011).

"Inequality is the planet's main 'environmental' problem. It is also its main 'development' problem." (World Commission on Environment and Development, 1987)

The above quote from the Brundtland report highlights the conflict between the need for the developing countries to develop in the future whilst still requiring a reduction of the overall worldwide impact on the environment, whilst the consequences of climate change create suffering for the poorest nations (Murray, 2011).

2.5.1.1. Definitions of Social Sustainability

McKenzie (2004) cites the following key characteristics in his working definition of social sustainability:

- Social Equity in ensuring fair and equal access to key services, equity between generations echoing the segment from the original Sustainable Development definition (World Commission on Environment and Development, 1987).
- Ensuring the protection of positive cultural aspects.
- Permitting political participation of all citizens in both local and national matters.
- Encouraging community ownership and ensuring that as a community there is a system for transmitting an awareness of social responsibility to future generations.
- Methods by which the community can identify and fulfil its own needs through community action.
- Methods to ensure that the needs that can't be met by the community can be met by a political advocate.

Defining social sustainability for a city, Polese and Stren (2000) state it is development or growth that is compatible with the society, allowing for cohabitation of a cultural and socially diverse groups, whilst also encouraging social integration and an improvement in the quality of life for all of the population.

Littig and Grießler (2005) define social sustainability initially in terms of a concept of needs as derived from the Brundtland definition (World Commission on Environment and Development, 1987) and claim that the Brundtland definition defines sustainability as a term that is human centred at its root (Littig and Grießler, 2005, Murray, 2011). The authors define 'needs' as the primary needs such as food, shelter, clothing, health care and sanitation that are necessities to live as well as secondary needs such as education, leisure, relationships and self-fulfilment arguing that these additional needs are required to enable individuals to take responsibility for shaping and improving their own lives (Littig and Grießler, 2005). To this end Littig and Grießler (2005) note that work is fundamentally important as a central aspect of social sustainability, not just in respect to individuals'

incomes but the wider benefits to the individual and society giving structure, time, identity and societal integration and encouraging social cohesion. Defining social sustainability the authors note the following:

"Social sustainability is a quality of societies. It signifies the nature-society relationships, mediated by work, as well as relationships within the society. Social sustainability is given, if work within a society and the related institutional arrangements; satisfy an extended set of human needs and are shaped in a way that nature and its reproductive capabilities are preserved over a long period of time and the normative claims of social justice, human dignity and participation are fulfilled." (Littig and Grießler, 2005)

Murray (2011) outlines the following conditions as necessary to support human wellbeing:

Food, water & nutrition	Gender equality	Security
Good health	Jobs with a living wage	Freedom from corruption
Access to childcare	Access to Justice	Diversity
Access to Education	Human rights	Work-life balance
Decent homes	Labour rights	Aesthetics
Exercise	Safety	Religion & spirituality

Table 1 Conditions to support human potential (Murray, 2011)

Colantonio (2009) notes that there is no consensus on the criteria that should be adopted when defining social sustainability, noting that definitions are often discipline specific. Colantonio, (2009) notes, however, that a number of common themes emerging from the literature including traditional issues such as basic needs and equity alongside emerging intangible aspects such as wellbeing and happiness. Table 2 below presents a summary of such issues.

Traditional	Emerging
Basic needs, including housing and environmental health	Demographic change (ageing, migration and mobility)
Education and skills	Social mixing and cohesion
Employment	Identity, sense of place and culture
Equity	Empowerment, participation and access
Human rights and gender	Health and Safety
Poverty	Social capital
Social justice	Well being, Happiness and Quality of Life

Table 2 Traditional and Emerging Social Sustainability Themes (Colantonio and Dixon, 2009)

In the most recent review of social sustainability the authors outline three approaches to social sustainability (Vallance et al., 2011):

- Developmental sustainability – addressing basic needs, the creation of social capital, justice and equity.
- Bridge sustainability – concerning changes in behaviour to achieve environmental goals.
- Maintenance sustainability – which addresses measures that seek to preserve aspects of society and cultures that could be subject to external change.

Under these headings Vallance et al, (2011) group a number of the sustainability issues that have been explored throughout this section, particularly the developmental considerations but also the notion of behaviour change which is included under the bridge sustainability issues. Whilst the notion of behaviour change is not disputed and is pertinent to 'design for behaviour change' (Lilley, 2009), as previously cited however, Page and Stewart (2007) and Vezzoli (2006) note that sustainable design is currently focussed on changing individuals habits for the environment sake rather than directly addressing societal needs. Whilst it could be argued that there is a place for both, this section intends to solely readdress the social balance in sustainable design.

The collective issues outlined in this section will be considered alongside social design issues outlined in the forthcoming section to produce a table of social sustainability design considerations that are applicable to product design.

2.5.2. Social Design

"Design can and must become a means for young people to take part in the transformation of society" (Papanek, 1974)

In addition to the previous section considering social sustainability issues this section examines social design issues and methodologies that are pertinent to product design. Looking at how social considerations within design are coming to the forefront today, with a number of leading bodies in the design world IDEO (2011) and the IDSA (Roux, 2011) turning their attentions to the societal implications of design as well as a stream in design activism (Fuad-Luke, 2009, Thorpe, 2008, Pilloton, 2009, Chick and Micklethwaite, 2011) specifically focussing on social issues.

In a report published in 2009 a Design Futures panel of 15 experts responsible for discussing the impact and changes that could be expected within the design industry by 2020 cited the following areas as particularly relevant (Williams et al., 2009):

- Self-actualisation design focussing on the top layers of Maslow's hierarchy of needs emphasising socialisation, tribal connectivity and quality of life.
- Ecological Design with designers considering systems and structures that enable sustainable living.
- Facilitation of design allowing the consumers to become creators, making their own products in the home through designed systems and software.
- Personalisation concerning products that evolve with the user and can be adapted to reflect the individual and their requirements.

- Localisation of manufacturing

The overarching theme was a focus on designers taking more responsibility for quality of life and environmental impact (Williams et al., 2009), which resonates with Griffiths and O'Rafferty (2010) who note that sustainable design is socially responsible design.

Literature concerning social aspects of design highlights a wide variety of concerns, and several areas are expanded upon in great depth, particularly user centred design approaches. However, for the purpose of this review an overview of the key terms and areas is presented. The following sections consider:

- Design for the Other 90%
- Design for the Developing World
- Ethical Design
- Inclusive or Universal Design
- Localisation
- Participatory Design
- Design for Personal Meaning

These sections will consider social design approaches that are predominately user centred and explore societal need, and consider such approaches for inclusion as aspects of social SPD.

2.5.2.1. Designing for the Other 90%

"Of the world's total population of 6.5 billion, close to 5.83 billion, or 90%, have little or no access to most of the products and services many of us take for granted; in fact nearly half do not have regular access to food, clean water, or shelter" (Smith, 2010).

Whiteley (1993) describes a design approach that is solely focussed on the richest segments of society, describing how design typically ignores those in

society that have little purchasing power, noting the elderly, disabled and underclass on a minimal income, whilst the earth's resources are plundered for the benefit of the few (Whiteley, 1993). In short, what Whiteley was calling for almost twenty years ago was a refocusing of design to consider the needs of the other 90% of the world's population, 'Design for the other 90%' (Smith, 2010). This link between current design and a the 10% of the population with a disposable income is echoed by others (Jue, 2011).

Addressing how to meet the needs of the other 90%, Jue (2011) suggests a number of considerations:

- Designing for ruthless affordability
- Design to create value locally
- Design to meet appropriate simple needs with basic features
- Learning about the specific local contexts in respect to the social, cultural engineering issues

'Design for the other 90%' however is a very complex term that serves as an umbrella term for a number of social design issues which will be explored in the following sections. Fuad-Luke (2010) describes the other 90% as the under consumers. In contrast to the 10% of over consumers the under consumers are focussed primarily on survival and striving to meet basic physiological needs (Fuad-Luke, 2009) at the bottom of Maslow's hierarchy of needs (Maslow, 1943).

2.5.2.2. Design for the Developing World

Designing to address the needs in developing countries is a well-established theme in social design and is cited by numerous authors (Margolin and Margolin, 2002, Papanek, 1974, Thomas, 1977, Murlis, 1977, Clifford, 2009). However, Whiteley (1993) notes the need for design for developing countries to be both socially and culturally appropriate (Whiteley, 1993, Chick and Micklethwaite, 2011, Capewell et al., 2004), suggesting that design in this context should be affordable, use local materials and skills, create local employment and be simple enough that it permits local

maintenance and repair (Whiteley, 1993), thus drawing parallels with localisation and participatory design.

2.5.2.3. Ethical Design

The concept of ethics is noted throughout social and sustainable design literature (Papanek, 1974, Papanek, 1995, Fuad-Luke, 2009, Murray, 2011), with Vezzoli (2006) and Chick (2009) both noting ethics in reference to the social considerations of sustainability as though the social-ethical aspects are inextricably linked (Vezzoli, 2006, Chick, 2009).

Ethical design is a difficult aspect to define and whilst professional bodies have codes of conduct (Chartered Society of Designers, 2004, Institute of Engineering Designers, 2007) these are generally generic and vague. Papanek (1995), gives examples of how a designer's ethics can be personal and dependant on an individual's values and beliefs (Papanek, 1995), whilst Murray (2011) notes that ethics, like morals, are external moderators of behaviour (Murray, 2011). There are calls within design for a greater focus on ethics, in particular calls for an ethical oath similar to the Hippocratic Oath that medical practitioners undertake (Thorpe, 2010, Pilloton, 2009). Papanek (1995) and Yang (2007) cite potential ethical conflicts emerging between a client and designer, when the designer is asked to do something, which helps the client but is detrimental to the end user of the product (Papanek, 1995, Yang, 2007). Yang (2007) cites ethical conflicts as existing in several areas of design including usability, marketing and the social impact. Cooper (2005) notes that ethical responsibilities involve doing the right thing and avoiding harm or injury and being derived from religious convictions, moral traditions, humane principles and human rights commitments (Cooper, 2005).

Ethical policies can form aspects of business corporate social responsibility (CSR) policies including social responsibilities to workers and environmental protection, although CSR policies are voluntary and therefore can focus on different areas to different degrees (Chick and Micklethwaite, 2011). A

number of organisations use CSR policies to address wider social issues that can be tackled through design including many of the issues explored throughout in this section (Chick and Micklethwaite, 2011).

2.5.2.4. Inclusive/Universal Design

Early literature such as Victor Papanek's text 'Design for the Real World' and the anthology of papers from the 1976 Design for Need conference (Bicknall and McQuiston, 1977) address social needs such as design for the disabled, and design for the aged. These criteria are also identified by others in later literature (Margolin and Margolin, 2002, Papanek, 1974, Fuad-Luke, 2009). Such issues can be referred to under the umbrella methodology of inclusive design or in certain spheres universal design and relate to well established fields that are largely self-explanatory and are explored extensively in literature, with the following principles of universal design are frequently cited:

Centre for Universal Design – 7 Principles of Universal Design

1. **Equitable Use**
   The design is useful and marketable to people with diverse abilities.
2. **Flexibility in Use**
   The design accommodates a wide range of individual preferences and abilities.
3. **Simple and Intuitive Use**
   Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
4. **Perceptible Information**
   The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
5. **Tolerance for Error**
   The design minimizes hazards and the adverse consequences of accidental or unintended actions.

6. **Low Physical Effort**
   The design can be used efficiently and comfortably and with a minimum of fatigue.
7. **Size and Space for Approach and Use**
   Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.
   (The Center for Universal Design, 1997)

Discussing an approach to design that accommodates the difficulties encountered by the elderly Whiteley (1993) discusses the terms ‘transgenerational’ (Whiteley, 1993) products or universal design that can be relevant to all age groups, old or young. Fuad-Luke (2009) describes universal design as an approach that encourages designs that should be equally accessible and can be experienced by the largest possible number of people and a term that is synonymous with design for accessibility, design for all, transgenerational design and inclusive design (Fuad-Luke, 2009).

2.5.2.5. Localisation

A number of areas of concern traditionally considered under designing for the need of the developing world such as cultural identity, local materials, employment and identity have evolved and been further refined recently and encapsulated in the term localisation (Walker, 2009, Porritt, 2007) which combines both the environmental and social concerns of SPD. Walker (2010) describes a localised scenario with local manufacture of parts supported by local services of design, manufacture, repair, upgrading, remanufacture and recycling, providing opportunities for local employment that would provide appropriate wages, working conditions and environmental legislation (Walker, 2010a) and producing products that are culturally relevant and personally meaningful (Walker, 2010b).

Vezzoli (2006) notes how locally based networks can help achieve sustainability through PSS approach, but clarifies that this shouldn't become localism (Thorpe, 2008, Vezzoli, 2006) and exclusive but foster a culture of "transcultural" diversity (Vezzoli, 2006).

There are a large number of new and emerging themes such as designing for social opportunity, a sense of belonging, community and self-esteem (Margolin and Margolin, 2002).

2.5.2.6. Participatory Design

Participatory design is a wide field in social sustainability addressing how the user can be considered, accommodated or even included in the design process. The need to consider the user and their specific needs in relation to their physical and or cultural requirements in the design process is noted in other sections including design for the developing world (Whiteley, 1993, Chick and Micklethwaite, 2011), inclusive design and localisation (Walker, 2010b).

Participatory design methods (Margolin and Margolin, 2002, Smith, 1977, Cross, 1972, Vezzoli, 2006) are noted in a number of sources under various headings such as Codesign (Fuad-Luke, 2009, Chick and Micklethwaite, 2011), Collaborative design (Fuad-Luke, 2009) and Participatory design (Fuad-Luke, 2009, Chick and Micklethwaite, 2011) involving the various stakeholders in the design process (Fuad-Luke, 2009). These terms typically differ in definition by how much input or control the end user has as illustrated in figure 10.

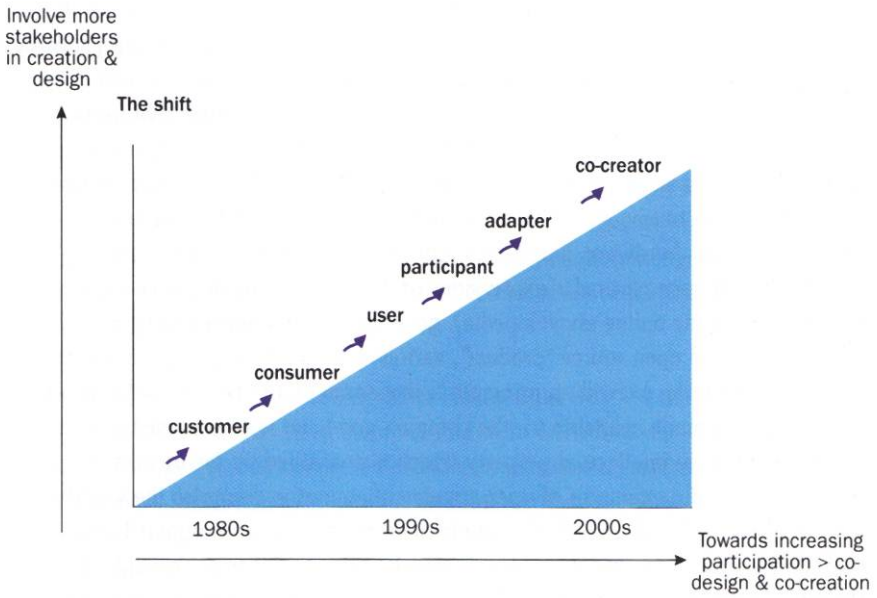


Figure 10 The shift from customers to co-creators (Fuad-Luke, 2009)

The detail in these differences between such terms however is not pertinent to this study, which is concerned more with ensuring that students have an awareness of such user centred approaches.

2.5.2.7. Personal Meaning

Walker (2010a) cites personal meaning as the fourth pillar in sustainability, describing how current approaches to sustainability lack a personal connection (Walker, 2010a). expanding this principle Walker notes the opportunities for culture and personal identity as well as sentimental value associated with the private, biographical and emotional life of an individual (Walker, 2010a), echoing the concept of emotionally durable design (Chapman, 2005), where personalised and or customised products can help to cultivate more emotionally durable relationships.

Walker (2010a) also describes how quality of life is different from standard of living, describing standard of life as referring to notions of material comfort and economic security, whilst the quality of life is concerned with personal, social, cultural and spiritual factors and concerned with a sense of meaning, identity, peace and wellbeing (Walker, 2010a). The notion of the importance of the consideration of quality of life and wellbeing to sustainability is

highlighted by others Porritt (2007), Griffiths and O'Rafferty (2010). Margolin and Margolin, (2002) describe how design should address social issues including fostering a sense of belonging, community and self esteem (Margolin and Margolin, 2002), in accordance with Walker's concepts of personal meaning and localisation.

2.5.3. Conclusions

Drawing together the sections on social sustainability and aspects of social design there are a number of parallels between social design concerns and the concerns of social sustainability. For instance design for the other 90% addresses many of the needs outlined in the wider social sustainability section, such as meeting the primary and secondary needs of the underprivileged (Littig and Grießler, 2005, Colantonio and Dixon, 2009, McKenzie, 2004), equity (Vallance et al., 2011, McKenzie, 2004, Colantonio and Dixon, 2009) and poverty (Colantonio and Dixon, 2009). Similarly the principles of localisation address notions of culturally relevant design (Colantonio and Dixon, 2009, Whiteley, 1993, McKenzie, 2004, Vallance et al., 2011), and the need to provide local employment opportunities (Colantonio and Dixon, 2009, Littig and Grießler, 2005), which in turn encourages social cohesion (Littig and Grießler, 2005, Colantonio and Dixon, 2009) as well as encouraging a sense of place and culture (Colantonio and Dixon, 2009).

A number of interrelated and co-dependent issues emerged such as these above, which is to be expected due to the complexity of sustainability. However distinct groupings have also emerged of issues that can be drawn together particularly in relation to the social design issues with overarching methodologies such as inclusive design, for example incorporating issues such as design for disability, design for the elderly, design for the developing world and affordability.

In order to simplify the criteria a number of the issues described in this section have been replaced by single terms where appropriate. These are shown in Table 3.

Key Term	Includes the following considerations
Affordable Design	Poverty, affordability, extended product life
Corporate Social Responsibility	Appropriate working conditions, health & safety, human rights, labour rights, ethical design
Culturally sensitive design	Cultural relevance, social integration, cultural identity
Design for Communities	Social cohesion, social integration, empowerment, community meeting their own needs, cultural identity, user centred
Design against Crime	Security, social cohesion, social justice
Design for the needs of the developing world	Culturally and socially sensitive design, participatory design, empowerment, appropriate design meeting basic needs, use of local, materials, skill and manufacturing, employment
Design for the other 90%	Affordability, addresses basic needs, user centred, provides local value, design for the needs of the developing world, inclusive design.
Design for True Need	Health, sanitation, food, security, shelter
Ethical design	Code of conduct, labour rights, human rights, usability, responsibilities to workers and local communities, no harm.
Inclusive/Universal Design	Social equity, social integration, diversity, demographic change, empowerment, quality of life, equitable design, design for all, design for disability, design for the elderly, transgenerational design, appropriate design, and universal design.
Emotionally Durable Design	Personal Meaning, personalisation, extending product life
Localisation	local materials, local employment, local repair, local manufacture, affordability, extending product life, local cultural identity, personal meaning, appropriate wages and working conditions.
Participatory Design	User centered design, collaborative design, co-design, stakeholder design, human participation, empowering individuals to meet their own needs.
Personal Meaning	Religion and spirituality, cultural and personal identity, sense of belonging, personalisation, identity, community, wellbeing
Social Equity	Fair Trade, employment, access to services such as education and health care
Social Justice	Appropriate working conditions, human rights, labour rights, security.
Wellbeing	Quality of life, employment, basic needs, security

Table 3 Social SPD aspects identified in literature

These literature findings will be considered alongside empirical research from the academic interviews and a set of social SPD issues will be outlined and addressed within the main study.

2.6. Team work in design education

Team work has been explored in this section in response to the recommendations from literature on education for sustainability, specifically the benefits of collaboration and group work in encouraging the consideration of different perspectives relevant to sustainability and the benefits of empowering students through peer to peer learning.

This section will consider literature on group work specific to design education, considering best practice, including the benefits of and any disadvantages of group work that could inform the further development of the research study.

2.6.1. Culture of group work in design

The requirement for group work in design education is multifaceted and integrating group work suits many demands of effective design education. Group work meets the wider demands of industry who have a preference for graduates with experience of working in multidisciplinary teams (Denton, 1997). Engaging students in group work projects permits longer more complex projects to be set that are more realistic and suited to industry (Denton, 1997, Crabtree et al., 1993), furthermore it offers the opportunity to mimic the multidisciplinary nature of teams in industry (Denton, 1997, Crabtree et al., 1993). Group work helps to build essential skills amongst students, such as social skills necessary in industry for interacting with clients and colleagues (Cross and Clayburn Cross, 1995, Crabtree et al., 1993), as well as cultivating critical thinking through the clarification and evaluation of others' ideas (Gokhale, 1995).

2.6.2. Benefits and pitfalls of a group work approach.

Denton (1997) states that teams are better at dealing with the ambiguity in design, because of their range of perspectives available and cites Driskell et al. (1987) who proposes that several minds working on a problem has the benefit of cancelling out any errors that an individual may make. Ehrlenspiel

(1997) affirms this, stating that teamwork leads to a better clarification of the task and a more intensive analysis of solutions presented.

2.6.2.1. Idea generation

Teamwork offers an increase in both the quantity and variety of concepts generated (Visser, 1993, Ehrlenspiel et al., 1997, Denton, 1997) generating more than the sum of its individual members (Denton, 1997). However, different team members may favour different concepts (Cross and Clayburn Cross, 1995, Ehrlenspiel et al., 1997) and difficulties in understanding others proposals can arise (Cross and Clayburn Cross, 1995, Ehrlenspiel et al., 1997). Ehrlenspiel et al., (1997) also found that team members can have a preference for, and become fixated upon their own ideas and design solutions, often rejecting others without sufficient analysis. This can be resolved if each team member is required to assess and develop another member's solution, overcoming the problems of personal preference and fixation (Ehrlenspiel et al., 1997) by giving shared ownership over a number of ideas. This experience of teamwork also enables students to gain different perspectives, encouraging them to examine their own values and preconceptions (Denton, 1997) and can lead to the ideas of individuals being used to 'leapfrog' to further ideas (Cross, 2007).

Visser (1993) found that evaluation of design solutions was broader and perhaps deeper when conducted by a team of designers when compared to that of an individual, as each of the designers involved focussed on different criteria or assessed the same criteria in different ways. This particular benefit of teamwork is also recognised by Denton (1997) who suggests that many minds cancel out errors that a lone individual may make. This attribute of teamwork is therefore crucial in ensuring a considered and impartial approach when using qualitative resources in education.

2.6.2.2. Team Conflict

Cross and Clayburn Cross (1995) note that reliance upon personal knowledge amongst designers, rather than formal knowledge sources could create difficulties within a team, leading to conflict between the team

members (Klein and LU, 1990). Cross and Clayburn Cross (1995) suggest that whilst disagreement in teams is inevitable, the team's desire and commitment to the design task will often require that disputes remain unresolved, or suitable agreements are reached for the sake of the project. This was evidenced in the analysis of the Delft protocols workshop (Cross and Clayburn Cross, 1995)., which found that team members reached a non-committal agreement postponing a dispute until a satisfactory argument could be found to support the views of one of the team members. In such instances the work of other designers is often used to refute an argument (Cross and Clayburn Cross, 1995).

2.6.2.3. Individual Dominance

Ehrlenspiel et al., (1997) comment that team discussion can be dominated by a confident individual, which results in good solutions being potentially lost due to a lack of assertiveness by other group members. Similarly individuals who were slower at developing ideas and solutions may be disadvantaged in a group situation, as other group members solutions may be considered first. However this can be overcome by proposing structure to the team based activity and ensuring that all solutions are documented (Ehrlenspiel et al., 1997).

2.6.2.4. Applying Teamwork in education

Denton (2000) found that undergraduate students can feel disadvantaged in a group work situation especially if they are placed with a student whom they perceive as weaker, and therefore suggests that team based projects shouldn't be conducted in the final year of a student's study in case it impairs performance or individual confidence (Denton, 2000). Denton also discussed the difficulties associated with team selection and concluded that whilst peer selection is the simplest method to manage, it is usually not the most effective our dynamic, suggesting that students are more likely to be drawn to people that are similar to them, both in interest and ability. It is better to consider a matrix of the students' marks to give an even ability level across the groups.

2.6.3. Conclusions

Group work in design has clear benefits and recognises the collaborative benefits found also in the education for sustainability section 2.1, enabling students to consider different perspectives and handle the ambiguity surrounding sustainability more easily. Group work also fosters key skills recognised in the education for sustainability literature such as critical thinking and critical reflection, whilst enabling more complex and interdisciplinary projects to be conducted with students. Such larger projects will also allow students to experience projects that have more relevance to real world situations and contexts. Whilst there are pitfalls associated with group work in respect to assessment and student attitudes, these can be effectively managed and are minor in contrast to the relevance and benefits of group work to SPD. Collaborative learning, including peer learning and assessment, will also help to empower the student, which was recognised as an essential aspect of education for sustainability in section 2.1.

Group work, collaboration and peer based learning will therefore be explored further through the empirical research as potential mechanisms for delivering effective teaching and learning in SPD.

2.7. Conclusions of the Literature Review

The literature has highlighted that a number of universities teach sustainability through product design courses and that SPD is predominately addressed in student projects. However, such teaching typically only considers the environmental considerations of SPD, neglecting the wider social considerations of sustainability (Ramirez, 2007c, Cull, 2005, Griffiths and O'Rafferty, 2010). In those studies that have demonstrated or endeavoured to address social sustainability only a narrow focus is considered, typically focussing on the user's behaviour or aspects of design for behaviour change(Cull, 2005, Clunes, 2009), which is focussed on changing individual habits for the sake of the environment rather than directly addressing societal needs (Page & Stewart, 2007; Vezzoli, 2006).

Therefore a key focus of the research will be a consideration of the wider social aspects of sustainable design as detailed in section 2.5. Cull (2005) described difficulties in addressing the intangible aspects of sustainability, which included the social aspects, noting that the learning demonstrated by the students in her study could have been only 'surface learning'. This suggests that 'deep learning' is required for students to fully engage with the multi-faceted nature of sustainable design and supports Warburton (2003) who describes deep learning as an essential ingredient in Education for Sustainability (Warburton, 2003).

The findings of the education for sustainability literature agreed with a number of key findings from the Net Generation literature namely the focus on collaborative learning and a relevant learning experience to foster deep learning. Whilst the Net generation literature also noted the learning preferences of contemporary students include peer interaction, learning through discovery and the use of visual methods. The literature on A/V learning resources also found common ground with both the requirements for education for sustainability such as encouraging critical reflection as well as the visual preferences and contemporary learning styles noted in the Net

Generation literature to foster relevance and motivation for deep learning. The research drew decisions based upon this literature to develop an A/V peer to peer based exercise for the main study. To ensure that a learning approach is adopted that encourages deep learning, and fostering elements of the education for sustainability literature, such as the personalisation of sustainability, group work and peer learning and the fostering of critical thinking and reflection. The latter two aspects were noted in the literature as particular weaknesses of Net generation learners.

Innovative teaching approaches such as immersive learning and deep learning have been explored from existing SPD education literature as offering potential vehicles for encouraging students to explore sustainable design aspects more holistically. In particular such approaches agree with a number of considerations within the education for sustainability, net generation and A/V learning resources literature. Therefore such methods will be explored more fully to identify methods through which students can be encouraged to consider the wider social aspects of sustainability.

Literature on the specific social design requirements of SPD was limited and inconclusive; therefore a wider multidisciplinary literature review was conducted in section 2.5. From which a number of criteria were developed from both the generic social sustainability literature and existing social design criteria. These criteria will be considered in relation to further research in the academic questionnaires and interviews to define a set of social considerations that inform the main study.

The literature review highlighted a number of key areas to be addressed in sustainable design education; however it is worth recognising that the literature from which these findings have been derived focussed predominantly on individual institutions (Gürel, 2010, Clunes, 2009, Wilgeroth et al., 2008) or a small number of regional institutions such as the two Scottish Universities in Cull's (2005) study or the four welsh institutions (O'Rafferty et al., 2008). Wider surveys have been conducted to investigate

sustainability on design courses at Universities in Italy (Vezzoli, 2003), Australia (Ramirez, 2006) and worldwide (Ramirez, 2007c). Whilst the worldwide survey had a number of key conclusions relevant to this research, it doesn't account for the different educational approaches of each country and how these affect the findings, nor does the survey mention any specific UK findings. Therefore the researcher recognises the need for a UK specific survey to be conducted as part of this study. A UK based survey was conducted (Humphies-Smith, 2008) amongst design and engineering courses in respect to sustainability. However the findings and focus of this survey were limited and did not address the scope of this research. As the study only surveyed departments that are accredited by the Institute for Engineering Designers (IED) and gathering opinion from academics, students and employers with a particular focus on employability and the students' need for and understanding of the sustainability in regard to future employment. This particular survey was also nonspecific in its field, addressing both designers and engineers, which have been previously shown in research to have very different needs (Durling et al., 1996).

Therefore in order to gain a wider perspective on SPD in the UK and test whether the key literature findings are true for the majority of universities within the UK, further research will be conducted in the form of a nationwide survey and a number of face to face interviews with academics who are engaged in SPD education within British and Irish Universities.

2.7.1. Research Gaps

The key gaps identified from the literature review are outlined below:

- The lack of a comprehensive survey of sustainable product design education within British Universities. As discussed in section 2.4, a limited number of universities have commented on specific module outcomes or the process of embedding sustainability in their curriculum but little is known about the state of sustainable product design education in the UK as a whole.

- A lack of resources that specifically address the social aspects of sustainable design. Literature uncovered a number of ecodesign initiatives; however these are inappropriate as they only consider the environmental and economic considerations of ecodesign, neglecting the additional social and ethical considerations.
- A lack of consideration of the social aspects of sustainable design within student design projects, instead maintaining a sole focus on the environmental aspects.
- A lack of literature discussing the teaching of the social aspects of sustainability, especially that is relevant to UK SPD education.

2.7.2. Research Questions arising from the literature review

Several research questions have arisen from the literature review, regarding specifically the social aspects of SPD.

- What are the limitations or barriers to teaching the social aspects of SPD?
- Which social aspects of SPD are taught in British Universities and how are they incorporated into the students' learning experience?
- What are the most appropriate methods for enabling students to engage with social aspects of sustainability and lead to an improvement in understanding?
- Can an appropriate method foster a change in individual students' attitudes?
- Can an appropriate method foster deep learning within the social aspects of SPD in individual students?
- Can an appropriate method effectively address multiple aspects of social sustainability?

The research will address these questions and answers will be considered within the research detailed in chapters 4 - 8.

Chapter 3. Research Methodology

'"Exactly!' said Deep Thought.' So once you do know what the question actually is, you'll know what the answer means."' (Adams, 1979)

This chapter will discuss how the research aims and objectives, set out in sections 1.2 and 1.3 were investigated, identifying and supporting the methodological approaches used in this research study. This research study is exploratory, investigating the current state of SPD education in the UK and the effects of teaching interventions on students understanding and application of the social aspects of SPD. Exploratory Research involves exploring an area where little is known, to investigate the possibility of undertaking a research study, often in the form of a research or pilot study (Kumar, 2005).

3.1. Research Type

The research inquiry is a mixture of qualitative and quantitative approaches, although the research is predominately qualitative due to the focus on social sustainability, the educational context and nature of the research techniques employed, including questionnaires, interviews and observation and analysis of student responses.

Kumar (2005) differentiates between qualitative and quantitative techniques by the mode of data collections, processing and analysis employed for each:

Qualitative research uses text as empirical material rather than numbers and analyses the experiences, interaction and communication of individuals or groups, using a wide variety of media including documents, images, film, text and music (Flick, 2009). Qualitative research is typically concerned with smaller sample sizes but considers multiple issues in greater depth. (Kumar, 2005, Black, 1999).

Quantitative research uses numbers and statistical methods, tending to rely on numerical measurement (Thomas, 2003) and is concerned with larger sample sizes (Kumar, 2005). Thomas (2003) suggests that quantitative research seeks to produce results that are readily generalised to other people and places, by using careful selected sampling strategies.

Stake (1995) describes the differences between qualitative and quantitative approaches in terms of the researcher's intent in interpretation of the data describing qualitative researchers as searching for happenings, whilst quantitative researchers look for causes (Stake, 1995).

Considering the data collection methods of the research study, the scope of the questionnaires suits the nature of quantitative methods due to the larger sample size involved and narrow depth of questions, whilst qualitative methods suit the nature of the academic interviews and analysis of student outputs which feature richer, more in depth responses.

3.2. Research Methodology Overview

This study comprises of three key research stages to address the research questions arising from the literature. Each stage utilises different methods of data collection including questionnaire, interview and analysis of student outputs, permitting triangulation of the findings, which can address potential bias within the study (Robson, 2001). The methodology used for each of these stages is mixed combining both qualitative and quantitative methods of inquiry and combining multiple sources in order to address areas of potential bias (Robson, 2001).

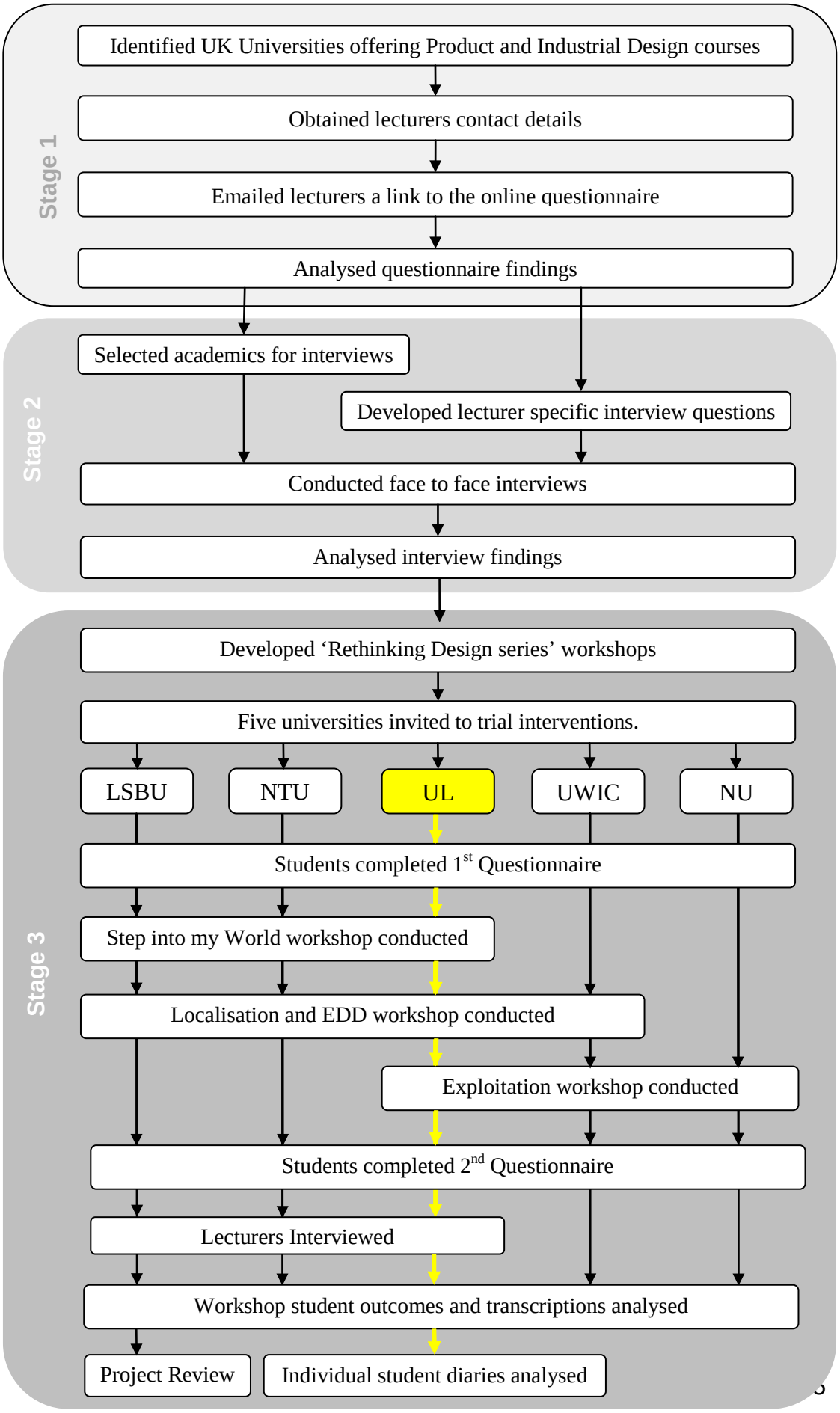
The first research stage addressed the need for a nationwide survey of existing SPD education provision in British Universities, as identified through the literature review. The data for this survey was collected through an online questionnaire conducted amongst 38 academics in 24 British Universities.

This review of existing provision in SPD within the UK address is considered important in widening the scope of the research to a national level permitting the findings from the research study to be generalised. It also recognises a limitation acknowledged by Clunes (2009), in his related doctoral study for a national review of sustainable design education rather than a localised view as presented in his study.

The second research stage built upon the survey findings collecting more detailed information on best practise, in teaching and learning, assessment methods and limitations within SPD education. This was achieved by conducting 9 semi structured face to face interviews with academics who currently teach SPD in a variety of universities throughout the UK. These academics were selected based upon their publications in the field of SPD and responses to the questionnaire conducted in stage one. The interviews were recorded with the permission of the academics, transcribed and analysed using coding and clustering techniques.

These first two stages of research provided a background understanding of sustainable design education within the UK, which the third study built upon. The third research stage investigated student responses to 3 teaching interventions called the ‘Rethinking Design series’ workshops, which were designed to encourage a consideration of the social aspects of sustainability. In order to allow findings to be generalised to the wider UK context, these workshops were conducted in 5 institutions, with different cultures in respect to the module type, student background and the position of design within the institution. The University of Limerick (UL) was used as the main in depth study, with the other four universities London South Bank University (LSBU), Nottingham Trent University (NTU), Northampton University (NU) and University of Wales Institute, Cardiff (UWIC) forming supporting case studies, which were used for comparison and to enable the findings to be generalised across universities throughout the UK. The main UL case study used multiple methods of data collection including student

questionnaires, analysis of student outputs in the form of diaries, workshop observation and staff interviews.


Stage 1
Identified UK Universities offering Product and Industrial Design courses
Obtained lecturers contact details
Emailed lecturers a link to the online questionnaire
Analysed questionnaire findings
Stage 2
Selected academics for interviews
Developed lecturer specific interview questions
Conducted face to face interviews
Analysed interview findings
Stage 3
Developed 'Rethinking Design series' workshops
Five universities invited to trial interventions.
LSBU
NTU
UL
UWIC
NU
Students completed 1st Questionnaire
Step into my World workshop conducted
Localisation and EDD workshop conducted
Exploitation workshop conducted
Students completed 2nd Questionnaire
Lecturers Interviewed
Workshop student outcomes and transcriptions analysed
Project Review
Individual student diaries analysed

3.3. Validity and Bias

In order to ensure that the research findings are valid it was important to minimise bias as much as possible. Bias is defined as: ‘a systematic or persistent tendency to make errors in the same direction, which is to overstate or understate the “true value” of an attribute’ (Lansing et al 1961). There is a need to manage and exclude disturbing influences, coming from either the outside or the researcher’s bias (Flick, 2009).
In terms of this research study, bias is discussed in terms of the respondents and researcher particularly in respect to the questionnaire and interviews. These two forms of bias are discussed below.

3.3.1. Respondent Bias

Interviewees can be obstructive and withhold information when they see the researcher as a threat or conversely they can be overly helpful, offering responses that they feel the researcher wants to hear (Robson, 2001). Respondent bias was felt to be a particular issue within the lecturer and student questionnaires as lecturers may wish to present their institutions in a good light and students’ opinions may be easily swayed by too direct questioning, or a wish to present themselves as more knowledgeable than they are. In order to address such bias a mixture of qualitative and quantitative questions were used as open ended qualitative questions require respondents to be able to demonstrate their understanding of specific areas of importance. Additionally in the student questionnaires selected questions asked students to rank generic terms or to indicate a preference for one of a number of statements, to obtain a more valid response rather than using direct questions.

Cohen (2005) states how invalidity can arise by respondent misconceptions in relation to what is being asked. This is difficult to address when conducting questionnaires due to the nature of distance between the researcher and respondent. However by following up a sample of the questionnaires with interviews the researcher can highlight such issues.

3.3.2. Researcher Bias

This can be informed by what the researcher brings to the situation in terms of their preconceptions and assumptions (Robson, 2001) and their expectations and attitudes (Cohen et al., 2005), which can affect the researcher's behaviour through the selection of the sample, questions posed, or the selection of data for analysis or reporting (Robson, 2001). Cohen (2005) describes how the interviewer can see the respondent in his or her own image, and seek answers that support their preconceived answers. Errors can also occur from misconceptions of what is being said (Cohen et al., 2005).

In order to overcome researcher bias Robson (2001) recommends an approach of reflexivity, citing Ahern (1999), by ensuring that the researcher identifies in their mind any personal feelings and preconceptions as this will enable them to be more alert to their influences and potential bias.

3.3.3. Triangulation

Triangulation is cited in the literature as a method for reducing potential bias by considering a number of different sources of evidence, viewpoints and research and analysis methods (Miles and Huberman, 1994, Robson, 2001). Robson (2001) cites four types as described by Denzin (1988) of which three were used in this research study:

- Data triangulation using more than one method of data collection such as interviews, questionnaires, observation and documents. This approach has been adopted in this study through the use of questionnaires, interviews and both formal and informal observations as data collection techniques.
- Observer triangulation, where more than one researcher is utilised in the study. The research study used member checking (Robson, 2001) by emailing transcripts of the interviews to interviewees for checking and reference. Peer debriefing and observation (Robson, 2001, Miles and Huberman, 1994) were also used to guard against potential bias.

- Methodological triangulation, using a mixture of qualitative and quantitative approaches. Although most of the research focuses on qualitative data the various questionnaire stages permit quantitative analysis of closed ended questions, which benefits the research.

3.4. Ethics

An ethical disclosure form was submitted to and accepted by the university ethics committee and all interview respondents have been given copies of the recordings and transcripts for checking.

The table in Appendix C outlines how ethics were assured during the Academic interviews by addressing Kvale (2009) 'Ethical issues at seven research stages'.

Ethics were assured throughout the main study, ensuring that students' names were not used in the analysis but were instead substituted for codes, to allow the researcher to identify each case. This method applied to all aspects of data collection; however names were requested in the main study questionnaires to allow students' responses between the two questionnaires to be connected up for analysis. All students were informed that the interventions were part of a research study to investigate the teaching of SPD and that their cooperation will not affect their grades or offer any tangible benefits. However intangible benefits may include an enhanced understanding of research methods gained from being involved in the process and the opportunity to learn from active reflection.

3.5. Analysis

Coding is the most prominent method of analysing qualitative data derived from interviews, observations and focus groups and can be applied to both visual and text based material (Flick, 2009). Coding was used as the key data analysis method for this proposed study due to the suitability and flexibility of the approach. Coding was used throughout the research study,

in all three research stages. The use of coding in the analysis of the open-ended questions from the online questionnaires enabled the answers to be translated into a set of standardised responses (Robson, 2001). Coding was also used in the analysis of the transcripts from the semi structured lecturer interviews and the student workshop outcomes observations and lecturer interviews.

The quantitative data collected from the closed ended questions featured in the initial online survey from study one and the student questionnaires in the third research study, were analysed and presented numerically and graphically where relevant.

3.6. Generalising Findings

Generalising is concerned with the repeatability of the study in the population and environment, within which one intends to generalise the data (Hammersley, 1993). Cohen (2005) states that being able to generalise is dependent on the transferability and comparability of the findings, being able to compare data between groups and indicating how data might be translated into different settings and cultures.

The generalisability of the findings from this research study was a key intention of the researcher, who wanted to ensure that any recommendations could inform product design teaching across the UK and Ireland.

The generalisability of the findings was considered in all three research stages. The research began with a nationwide academic survey. Whilst it is difficult to measure the percentage of UK academics who replied due to a number of academics forwarding the email to other colleagues and the nature of some institution websites that were out or date or incorrect. It was possible to gauge the response rate and range based upon their universities, with the results representing 60% of all the universities in the UK that teach product and industrial design.

To be able to generalise from the findings there must be a relationship established between the sample and the target population (Oppenheim, 1992). Establishing a degree of representativeness between the sample and the wider population allows the researcher to make broader inferences about the whole population (Arber, 1993). Hamersley (1992) suggests three potential methods to support generalisations from a single case study:

- Obtaining information about relevant aspects of the population of the cases and comparing the researched case with them.
- Using survey research on a random sample of cases.
- Coordinating several ethnographic studies.

Silverman (2010) notes however that the latter two approaches are too ambitious for the research student, noting that the first method is most suitable.

Therefore the third research stage sought information on the population of each case to enable the outcome of the case studies to be generalised to a wider population. This was achieved by combining data from the Higher Education Statistics Agency (HESA) on the participation of underrepresented students at each institution with background information on each of the students involved in the main study institution. The individual student data was collected through two questions at the start of the first student questionnaire and sought geographical data collected on the student's home region. This information will be used to ensure that the study covers the breadth of the UK geographically and includes a proportion of students from different entry routes thereby ensuring that students from all backgrounds were considered. The HESA data on students from underrepresented backgrounds was used to calculate the percentile of underrepresented students at each of the universities involved and is included in Table 5 in the following section.

3.6.1. Selecting Cases

Creswell (2007) suggests that when selecting a case the researcher should establish a rationale for the purposive sampling strategy. In the following sections the rationale for the selected sample is described.

3.6.1.1. Stage 1 – Online Questionnaire

In the first stage of research the sample could be described as self-selecting. A review of all the universities that offered courses in industrial or product design had already been conducted through the use of the UCAS website. Contact details for lecturers within each university were obtained either from departmental pages on the university's website or by contacting the university department directly by telephone. An individual personalised email invitation was then sent to at least one lecturer in product or industrial design at each of the courses offered in the UK. In some instances further lecturers at each university were invited if the first proved to be unsuccessful or the initial lecturer forwarded on the email to additional colleagues. Whilst email reminders were sent to non-respondents the researcher was very dependent on the goodwill of lecturers for responses and therefore the sample was self-selecting in this nature.

3.6.1.2. Stage 2 – Academic Interviews

Flick (2009) describes sampling as a method of selecting and focussing the selection of people to be interviewed, situations to be observed and geographical sites where these people and situations can be found, suggesting that through these selections, generalisations can be made that go beyond the research situations and participants involved (Flick, 2009).

Nine academics were interviewed about their experiences of teaching SPD. Criteria used to select these academics considered their publications within SPD, the nature of the courses on which they taught and in certain cases the responses given in the initial questionnaire, which the researcher wished to follow up. All the academics selected for interview taught on undergraduate or postgraduate courses in 3D Design or Product Design.

The sample was split equally between academics who had taught on undergraduate courses and postgraduate courses. The academics names have been replace by codes (A1 – A9) as shown below in table 4 to preserve anonymity.

Such criteria enabled a wider sample of academics to be considered so that the findings could be generalised. The researcher was conscious of potential bias in the sample and so selected academics for reasons other than publications in the field as this would have restricted the selection to research intensive universities, ignoring contributions from new universities that typically have a greater focus on teaching and industry collaboration. Many of the lecturers contacted for interviews were very willing to be involved in the study with the exception of two who didn't respond or declined the request. However an alternative interview was managed with a different academic in one instance so that the course and institution was still represented. Table 4 presents the reasons for selecting each academic.

ID	Publications	Teaching	Survey	Course Type	Additional Info
A1	SPD education paper	Postgraduate	N	MA Design Interdisciplinary	Director of Research Centre
A2	SD paper	Postgraduate	N	MSc Sustainable Product	
A3	SD education papers	Undergraduate Postgraduate	N	Distance learning	Developed SD resource
A4	SPD education paper	Undergraduate Postgraduate	Y	BA/BSc Product MA Design	Developed SD teaching resource
A5	SPD education paper	Undergraduate	N	BSc Product	
A6	Numerous papers	Undergraduate Postgraduate	Y	BA/MA Product Interdisciplinary	Director of MA courses
A7	Numerous SD papers/books	Postgraduate	N	MA Design Management	Co-Director of Research Centre
A8	N/A	Undergraduate	Y	BA Design Maker	Visiting SD lecturer & owner of eco-furniture consultancy
A9	Numerous SD papers & book	Undergraduate Postgraduate	Y	BA/BSc/MSc Product	Head of SD Research Group

Table 4 Academic interviews selection criteria

3.6.1.3. Stage 3 - Main Study

Discussing sampling, Silverman (2010) suggests setting up a typology or matrix, outlining the areas which can be addressed through the studies and then selecting samples from those that will best suit the intended nature of the research. Considerations such as setting the boundaries for the case study, including firm start and end points and detailing the information to be acquired for each case are required (Silverman, 2010, Creswell, 2007). An example of this matrix is presented in Table 5, representing the institutions involved in the Main Study.

In order to survey the greatest population range possible the universities were selected based on the social economic status of their students as well as their location and department culture. The issue of availability was a consideration but the contacts made during the first and second stages of research and the successful dissemination of the nationwide questionnaire findings ensured that sufficient universities were interested in conducting the trials.

	London South Bank	Northampton University	Nottingham Trent University	University of Limerick	University of Wales Institute, Cardiff
Social Economic Make up of students[1]	49% of students from low income backgrounds (92nd percentile)	42.5% of students from low income backgrounds (80th percentile)	35.8% of students from low income backgrounds (49th percentile)	Information not available as outside of UK.	39% of students from low income backgrounds (64th percentile)
Student Age	Mixture typically mature students, some Erasmus students	Mixture of students from school or college and mature students.	Students typically straight from A 'levels, few international	Students typically straight from A 'levels, few international	Half recent British graduates and half mature international students
Culture of Department	BSc courses in Product Design, Engineering Design and Sports Product Design in the department of Engineering	Art School culture Art and Eng only campus. Supports regional industry. Local social focus in design projects. BSc course	BSc technical engineering focus BA more design orientated. Emerging focus on sustainability due to recent Professorship	BSc course in the department of Engineering Good links with local community	Taught MSc course in a studio teaching environment Teaching input from the Eco Design Centre Wales
Type of teaching	Informal lecture and tutorials in studios	Informal lecture and tutorial format with studios	Informal studio/ classroom teaching	Informal studio based teaching	Informal studio based teaching
Curriculum Social Vs Environmental	Environmental and social aspects in separate projects	Design for real world module contains an equal mix	Environment bias in BSc module, more even mix on BA module	Environmental and social aspects in separate modules	Environment bias in module links to EDC Wales
Assessment Method	Design Project	Essay	Project based	Diary, Debate, Essay	Design Project

Table 5 Case Selection Matrix

[1] Figures and percentiles for each UK institution were calculated from the 2008/09 Higher Education Statistics Agency Data. Data for Ireland was not made available to the researcher.

The universities chosen were diverse with their departments displaying their own distinct cultures dependant largely on the faculty they belong to as well as the type and structure of the university.

- London South Bank University is located in the capital city and draws many of its students locally from some of the poorest boroughs in the city (Andrews, 2010). Additionally there are a higher proportion of mature students. The BSc design courses are taught together within the Department of Engineering.
- Northampton University is a small university that maintains strong local connections within industry and the town's heritage including the institutions world leading leather technology centre, which serves the footwear industries worldwide. The majority of students are also drawn from Northamptonshire or adjoining counties. The university is located across two separate campuses with the Design department being located within the Arts School.
- Nottingham Trent University offers perspectives from both a 1st year and a BA and BSc perspective, unlike any of the other universities involved in the main study. The BSc course has a strong technical emphasis with elements of engineering biased, but both courses reside in the School of Architecture, Design and the Built Environment. The university represents a wider and more even distribution of students from different regions of the UK than the other institutions involved in the study.
- The University of Limerick is based in western Ireland and offered a unique Irish perspective to the study and a different assessment method to the other universities involved in the trials. This university also offered the flexibility to run all three 'Rethinking Design' Workshops consecutively, resulting in a highly data rich case study. The BSc Product Design course is located in the Department of Engineering.
- University of Wales Institute, Cardiff focused on MSc students assessing the effectiveness of the trials at a postgraduate level and also benefited from strong links within Wales particularly with the Eco

Design Centre. The MSc in Advanced Product Design is located in the Cardiff School of Art and Design.

The differences in physical location, faculty culture, combined with differences in student background will give a more representative view of the product design students in universities across Britain so that the results will lend themselves to future research and application.

The host institution, Loughborough University wasn't included in the third research stage as there was a lack of opportunity within the curriculum to engage with the 'Rethinking Design series' workshops, but was represented in the first and second research stages.

3.7. Data Collection Methods

Data collection methods were selected based upon their suitability for the research focus as well as their potential to add to the robustness of the research. Questionnaires enabled the researcher to conduct a far wider survey of academics, giving a broader understanding of SPD education in the UK than interviews would allow. These questionnaires informed the subsequent academic interviews and helped to make academics aware of the research, which widened opportunities within stage three of the research. The academic interviews were important in establishing best practice and common issues prevalent in SPD from expert practitioners. Additional data collection approaches were utilised in the final main study, including student questionnaires, group observation through audio and photographic data collection and lecturer interviews. His data was collected from different sources and using different method to allow for triangulation and to ensure validity in the analysis of the findings, so that conclusions can be drawn on the effectiveness of the interventions.

3.7.1. Stage 1 - Online Survey

An online nationwide questionnaire was conducted using the Bristol Online Surveys web based resource. The intention of the survey was to determine

the extent of sustainability within product and industrial design courses in the UK. The survey required a large number of institutions to be contacted and therefore an online questionnaire format was considered the most appropriate method. The online self-directed format permitted individually addressed emails to be sent to lecturers on product and industrial design courses in the UK inviting them to participate in the research by completing the questionnaire with an enclosed web link. An example of this invitation is available in Appendix E.

The online nature ensured that the rules of the questionnaires had to be followed, with the respondent only allowed to give the correct number of answers, avoiding ambiguity or errors in the later analysis (Fink et al., 2003). The purpose of the questionnaire was to review the current state of SPD education in the UK, therefore it was important to have the largest possible sample to ensure accuracy.

3.7.1.1. Questionnaire Design

Personal email invitations with a link to the online questionnaire were sent to 80 product and industrial design lecturers, representing 40 universities in total.

The questionnaire contained 15 questions of which the first 3 were merely administrative to ascertain the breadth of response. The questionnaire was semi-structured, containing a mix of open-ended qualitative responses and closed predetermined response questions that can be analysed quantitatively (Gillham, 2000a). A higher ratio of quantitative questions to qualitative questions was used to encourage a high response rate as lengthy open-ended responses are typically not well received (Fink et al., 2003). The survey contained 9 quantitative multiple choice responses with predetermined statements and tick boxes and 3 qualitative open ended questions, requiring an open-ended personal response. Fink et al., (2003) notes that most self-administered surveys should be comprised of closed-ended questions but highly motivated respondents may be willing to answer a few open-ended questions (Fink et al., 2003). Qualitative questions were

asked when the subject matter deemed them necessary (Gillham, 2000a), for instance when describing lecturer's understanding of sustainable design. Lecturers were permitted to add additional information to the quantitative questions by utilising the comments box. Additionally five of the multiple choice questions gave the option for academics to specify their own answers, by selecting 'other' and entering their own criteria, as it was understood that lecturers may want to give their own views and opinions. An example of the questions is available in Appendix F.

3.7.1.2. Limitations of Questionnaire Methods

Gillham (2000) cites a number of disadvantages of questionnaires; these have been considered in full by the researcher in Appendix D, which outlines how the disadvantages of the questionnaire format have been addressed in the questionnaire design.

3.7.1.3. Questionnaire Analysis

The structure of the questionnaire enabled many of the closed questions to be analysed in a quantitative manner, these were predominately multiple choice and allowed for the responses to be calculated as percentages and the results to be shown graphically. Coding and clustering techniques were used to analyse the data obtained from the open-ended qualitative questions because this approach enables data to be reviewed and dissected in a meaningful way whilst maintaining the relationships between the data (Miles and Huberman, 1994). This is discussed in more detail under interview analysis in section 3.7.2.2. In the multiple choice questions content entered under the 'other' category was also subjected to coding and clustering if it was deemed to be statistically significant, otherwise these responses were recorded in the graphs under 'other'.

3.7.2. Stage 2 – Semi-Structured Interviews

Kvale (2009) states that semi-structured interviews have a sequence of themes to be covered as well as some prepared questions, with an openness to change either the sequence or the form of questions to allow for follow up of answers given. The semi structured interviews enabled the

researcher to follow up questions which had emerged from the nationwide questionnaire and provided an opportunity to gain a fuller understanding of the current state of SPD education. A semi structured nature was used as it permitted the researcher to pose framework questions, which would allow individual academics freedom to discuss their particular experiences and opinions in relation to their teaching of SPD.

Face to face interviews were conducted with the academics. Four were interviewed whilst visiting Loughborough University, whilst the remaining five were visited at their home institution. Face to face interviews were preferred to telephone interviews as they offered the opportunity to meet the academics and better judge responses through visual communication, which meant that interruptions and talking over each other were less likely. Face to face interviews are also recommended where the research aims mainly require insight and understanding (Gillham, 2000b), which were the main purposes of this research stage. Visits to the institutions and the opportunities to see students work was also an added benefit in a number of cases.

Interviewees were recorded using two MP3 voice recorders, so that a backup recording was available. Interviews typically lasted between 45 minutes and one and a half hours, with the duration dependant largely on the lecturer's personality and availability.

3.7.2.1. Interview Design

Prior to each interview an individual set of interview questions were drawn up, for each academic. These questions were based upon findings from the literature review, online questionnaire and direct questions specific to aspects of the courses or modules taught by the academics. Such information was obtained in advance of the interview from the academic themselves or via the institution or departments webpage's.

The semi-structured nature of questioning risks potential bias as questions can seem to be leading especially when examples are given by the researcher (Kvale, 2009) who holds a position of power as interviewer. However, this was not the case as the academics' expertise and status, shifted the power balance in favour of the interviewee rather than the interviewer (Kvale, 2009). The academics demonstrated this through their responses, which showed that they felt comfortable in asserting their opinions, and disagreeing with particular questions or strategies. Two examples of this are given below:

An academic's view on tools after the researcher asked for suggestions for a proposed tool at Loughborough University:
'Well it's definitely not here is a tool go use it, it's definitely not the eco Indicator approach. I personally have big issues with that kind of approach because I don't think you can put sustainability in a computer program.' (A7)

An academic reordering the question criteria:
'I would, sorry ask an academic and they restructure your topics but, it's always difficult because we are in the infancy of structuring these areas and the sub sections within it and I'm increasingly coming to the conclusion that it isn't helpful almost having design for sustainability as a topic' (A1)

Each interview followed a similar script with specific questions relating to the individuals courses see Appendix G. However questions were skipped when it was clear that these were inappropriate or in fact had been answered in the previous dialogue. The interviews varied in length and it was found that the later interviews were typically longer than earlier interviews. This was partly due the researcher becoming more at ease with the process. The researcher didn't stick strictly to timings for the interviews in fear that rich detail may be lost, although in a couple of cases the interviews were time limited by the academic's schedule. However all academics were willing to let the interviews run over the allotted time and one academic (A7) was 10 minutes late to a meeting due to his willingness to continue.

3.7.2.2. Interview Analysis

The interviews were fully transcribed from the MP3 recordings with timings and an example can be found in Appendix H accompanied by the corresponding interview questions in Appendix G. Once completed the transcripts and original recordings were emailed to the interviewee for member checking this enabled academics to check the transcripts and clarify any errors or aspects they disagreed with.

Flick (2009) states that coding is the most prominent method of analysing data derived from interviews and so the transcripts were coded and clustered, grouping similar coded sections together in individual documents under document macro codes. Miles and Huberman (1994) described coding as clear categories or codes, organised into an explicit structure embodied in a thesaurus or codebook and paired with appropriate statements or findings, which can be analytical or descriptive in style and can be comprehensive or precise in outlook (Miles and Huberman, 1994). Codes were derived from an overview of the first three transcripts and these codes were then used as base codes and modified accordingly for the transcription of the other 6 interviews. As Miles and Huberman (1994) note, a coding system can be designed to allow for change during the research. Clustering was achieved by grouping similarly coded sections together and involved copying and pasting the codes into the 6 macro code documents below:

- Course Content and Structure (Cor)
- Assessment and Learning Style (A&L)
- Staff Understanding and Collaboration (Staff)
- Sustainability Statements (Sus)
- Student Attitudes towards Sustainability (Stud)
- Limitations in teaching SPD (Lim)

The coding used consisted of a cluster or document code as noted above which grouped together a number of different areas as 2nd level codes, related to focus of the cluster. In certain cases a 3rd level micro code would

be used to allow for greater detail to be incorporated in the coding. An example of such a code structure is described below:

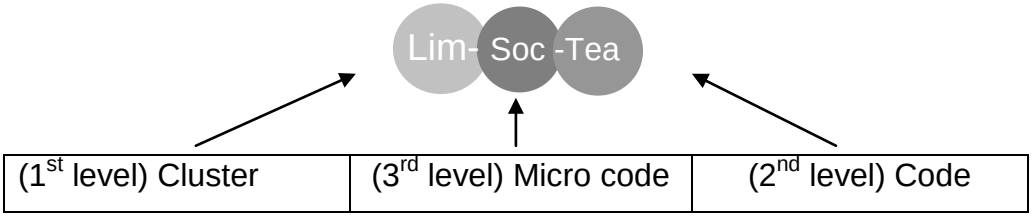


Figure 11 Illustration of coding construction

Figure 11 Demonstrates how the codes are constructed the 1st level relates to the cluster or document code and in this instance refers to the Limitations in teaching SPD (Lim) cluster. The second level code refers to an area within this cluster in this case referring to teaching (Tea) and the 3rd level codes relates to the detail, highlighting that the coded statement is referring specifically to the social aspects of sustainability (Soc). Therefore the coded sequence describes a comment that considers a 'limitation to the teaching of the social aspects of sustainability'. An excerpt of coding from the academic interviews code can be found in Appendix I with the corresponding code meanings in Appendix J.

Where coded sections were applicable to more than one code or cluster, they were clustered numerous times into different sections. Compiling the coded statements into the 6 cluster documents enabled the researcher to more readily recognise the key findings and to focus on these. Typically the key findings related to course content and structure, assessment and learning style and limitations in teaching SPD. However other macro codes also provided interesting findings such as the sustainability statements macro document which included coded statements relating to the academics opinions on terminology used in SPD.

The coding process was beneficial in enabling the researcher to draw together similar findings and derive greater detail and meaning from the transcripts by focussing in detail on specific findings and highlighting subtle differences between the academics opinions and perspectives.

3.7.2.3. Follow on Interviews

Further interviews were conducted with three other academics to discuss different aspects of the study. They were conducted in the same way, preparing an interview prompt script and conducting the interview face to face in a semi-structured format. Two of the interviews questioned academics in the UK specifically about group and teamwork in design education, with questions relating to methods they used for assessment, students attitudes, difficulty and outcomes. The first interview was conducted with an expert in the field who had published a number of papers on teamwork in design. The second interview was conducted with an academic who had applied the BELBIN® (BELBIN, 2012) principles in team design in a postgraduate sustainable design module. A final interview was conducted with an academic from Australia regarding his doctoral study into SPD education in Australia with the questions being derived from an understanding of the academics thesis and the researcher's particular interests in his own study. The unique opportunity for this interview arose from a meeting at an international conference.

3.7.3. Stage 3 – Main Study Interventions

This final stage constituted the main study and considered how to encourage students to address the social considerations of SPD and encourage deep learning experiences.

The main study was conducted as an collective case study and multiple methods of data collection were used within each case to triangulate (Corbin and Strauss, 2008) the findings. This final study reflects on a number of findings from the earlier research stages, specifically seeking to address students' difficulties in addressing the social aspects of sustainable design. Drawing upon the research findings to date three social sustainability workshops were developed and conducted with undergraduate and postgraduate students at the universities outlined earlier in this chapter. The workshop outcomes were documented through audio recordings and photographs of mind maps demonstrating the students' progress. The

students' responses to the workshops were gathered from these workshop interactions and questionnaires that were conducted before and after the workshops. In addition teaching staff present in the workshops At LSBU, NTU and UL were interviewed. Individual student diaries from the University of Limerick and project outcomes from LSBU were also analysed for references to the workshops.

3.7.3.1. Case Study

A case study is the study of a situation, group, organisation or almost anything which, can be considered as the case including an innovation or service (Robson, 2001). Involving the study of an issue through one or more cases within a bounded system such as a specific setting or context (Creswell, 2007). The case itself is defined as a specific, complex and functioning thing subject to boundaries (Stake, 1995). Case studies are unique in their ability to practise research of real people in real situations, (Cohen et al., 2005). Cohen (2005) draws similarities between case studies and television documentaries because of their ability to present events and situations factually and not interpretively.

Case studies involve in-depth data collection consisting of a variety of sources such as observations, interviews, audio-visual material, documents and reports (Creswell, 2007). The case study will typically involve multiple methods of data collection (Robson, 2001, Corbin and Strauss, 2008), both qualitative research but also including quantitative data where applicable (Robson, 2001) permitting the triangulation of data (Corbin and Strauss, 2008) to reinforce conclusions. Robson (1993) suggests that to study a case qualitatively requires consideration of the phenomenon alongside the context and situation of the study, which Cohen (2005) considers the key strength of case studies. Hitchcock and Hughes (2005) suggest that a characteristic case study is concerned with:

- The description of events related to the case.
- Providing a chronological narrative of events.
- An internal debate between the descriptions and analysis of events.

- The perception and understanding of events by the participants.
- Highlighting events relative to the case.
- Research that is integrally involved.
- A rich portrayal of the research in the write up.

There are three types of case studies, intrinsic, instrumental and collective (Creswell, 2007, Silverman, 2010, Stake, 1995). Intrinsic case studies are interested in the specific case, without any attempt to generalise beyond the case of build any theories from its findings (Silverman, 2010) and are therefore of no interest to this particular research, which is interested in widely generalising findings for the benefit of other universities.
An instrumental case study uses an individual case study to illustrate a single issue or concern (Creswell, 2007, Stake, 1995) and can also be used to revise a generalisation if required (Silverman, 2010).

The design of the main study is most suited to the collective case study otherwise known as a multiple case study (Yin, 2009), which concerns a single issue or concern, but is illustrated through the investigation of a number of case studies (Silverman, 2010). Stake (1995), comments that a collective case study may be designed to consider representation of the population within the sample. Multiple case study approaches are used where more than one environment is being considered, allowing cases to be selected, which highlight different perspectives on the issue (Creswell, 2007). The evidence from multiple case studies is considered more compelling, and therefore the study is regarded as generally more robust than a single case study approach (Yin, 2009).

3.7.3.2. Institution Case Studies

A collective or multiple case study approach best suits the requirements of this research study permitting a number of cases to investigate the same phenomenon in the five universities conducting the workshops. The findings and conclusions across all five case studies were drawn together to highlight common findings and investigate any distinct differences in the

findings. This was achieved by highlighting the University of Limerick as the key detailed case study. The reason for selecting the University of Limerick (UL) as the main in-depth case study, are outlined below:

- The opportunity to trial all three ‘Rethinking Design’ workshops within the same institution on the same day, providing a benchmark to compare the other trials to.
- The wide availability of data available from the three trials.
- The benefit that all three workshops were performed consecutively on the same day permitting the questionnaires to be performed before and after without any delay. This ensured that all the workshops are still fresh in the student’s minds and there was no opportunity for contamination of confusion from other influences such as modules or lectures.
- The other universities are all UK institutions which suits the purposes of generalising the findings unlike UL, which is an Irish university and so a better candidate for the in-depth study.
- The workshops conducted at the UL were conducted by the resident lecturer under the instruction of the researcher. This permitted the testing of the repeatability of the research and the ability for the workshops to be used independently by staff.

However the benefits of using the UL as the main in-depth detailed study does not negate the importance of the other universities representing the supporting studies involved in the study. Rather access to the other universities was restrictive due to the availability of time within the module. UL was particularly supportive of the research and the lecturer in charge of the module had the unique opportunity of having a block of lectures in a specific week rather than across the semester which enabled uninterrupted access to the students.

3.7.3.3. Sampling

Student feedback via questionnaire could be described as self-selecting as the researcher was limited by those students that were willing to cooperate.

However, the returns rate on both the questionnaires was high at all institutions possibly as the students saw the task as part of the workshop exercises.

3.7.3.4. Analysis

The effectiveness of the teaching interventions was measured by multiple methods of data collection including student questionnaires completed before and after the module or intervention to ascertain any learning from the 'Rethinking Design workshops' and any changes in the students' preconceptions, attitudes or opinions.

Student's physical and verbal responses during the workshop were recorded by photography and audio recording, whilst project outcomes were also considered at LSBU and student diaries at the University of Limerick. Lecturers present during the workshops were also interviewed regarding their opinions on the impact, effectiveness and repeatability of the workshops. Each of these will be outlined below in more detail and the process is demonstrated in figure 12.

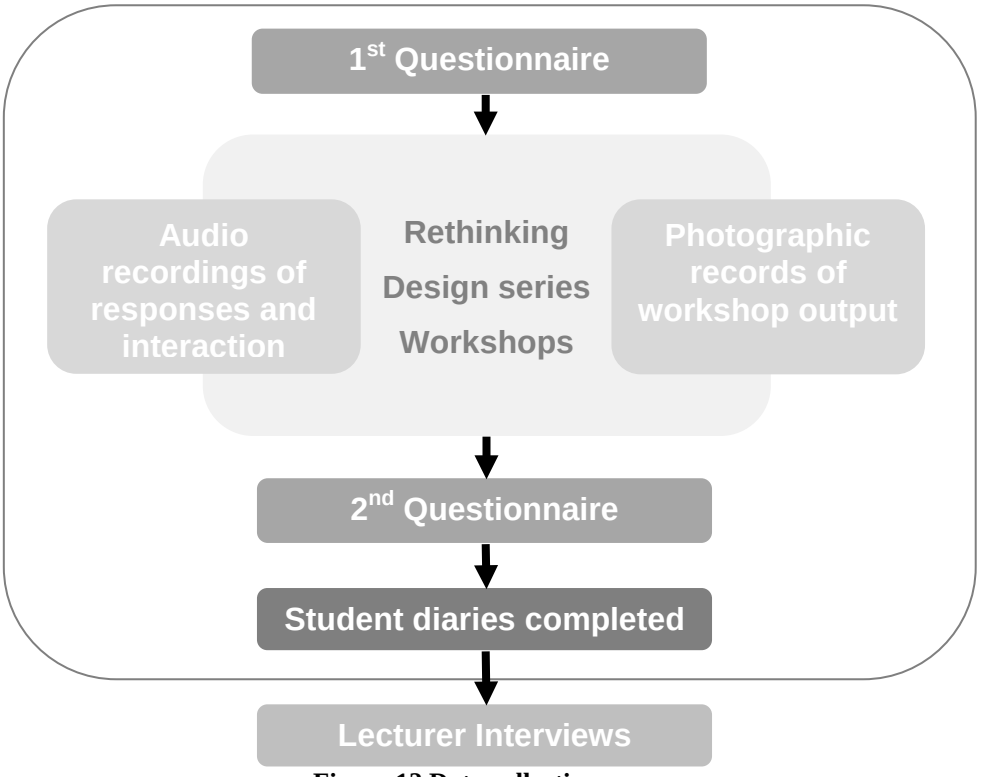


Figure 12 Data collection process

3.7.3.5. Student Questionnaires

Two questionnaires available in Appendix K and Appendix L were given to students either, at the beginning and end of the module, or before and after the workshops dependant on the institution in question. The two questionnaires were very similar with a series of identical questions to measure changes in individual students learning and attitudes, supplemented by additional questions in both questionnaires. In the first questionnaire questions relating to the students geographical and educational background were posed for generalising purposes and in the second questionnaire relating to the students' opinions of the workshops.

The questionnaire format was a mixture of open and closed questions. Ideally all of the questions would have been open but in order to maximise completions open questions were kept to a minimum and were as expected found to be the most frequently missed questions in the questionnaires, a finding which justifies the questionnaire design. The responses to the questionnaire were analysed using coding for the open questions and quantitative measures producing graphical representations of the closed multiple choice questions.

3.7.3.6. Workshop Outcomes

The workshops conducted at LSBU, NU, NTU, UL and UWIC featured A/V introductions see section 6.2, followed by group discussion and a mind mapping session in relation to each of the A/V introductions. The students' interaction was audio recorded and photographs were taken of each student group's mind maps throughout the workshop sessions.

The audio recordings were transcribed and analysed using coding and clustering techniques as described in section 3.7.2.2 an example of a coded audio transcript is shown in Appendix M. The transcripts were compared to the mind maps produced during the workshops and gave additional insight and understanding, especially in a number of cases where students had written single words on the mind maps. In such instances the audio

transcripts explained how the students had come to the conclusion and put the phrase into context. The mind maps were also coded and clustered based on content, student impressions and attitudes, an example of a coded mind map is shown in Appendix N, with a sample of coding meanings from the workshop materials in Appendix O. These two material sources were considered alongside the questionnaire findings to consider the effectiveness of the workshops and considered changes in the students' learning, understanding and attitudes towards the social aspects of SPD, as well as evidence of deep learning and design thinking occurring.

3.7.3.7. Student Diaries

Student diaries from UL were considered and excerpts where students had reported on the 'Rethinking Design series' workshops were photocopied and analysed in a similar method to the workshop outcomes using a coding and clustering approach to elicit meaning from the material, an excerpt from the clustering is shown in Appendix P and a Diary excerpt is included in Appendix Q with an sample of coding meanings for the student diaries in Appendix U. Not all students commented on the workshops in their journals as it was the student's choice what they reflected on throughout the module in their diaries however 12 of the students wrote in length on the workshops typically covering multiple sides of A4.

The reflective nature of the student diaries meant that the diaries gave a more personal account of the workshops from the individual perspectives of the students and because the diaries were conducted after the workshops were conducted they gave a more reflective and longer term insight into the effectiveness of the workshops in relation to student attitudes and practice. The student diaries were considered alongside the other findings from the workshop outcomes and student questionnaires.

3.7.3.8. Lecturer Interviews

The lecturer interviews were conducted and analysed using the same format for the earlier academic interviews described in section 3.7.2.2. The interviews were conducted with the lecturers involved at the end of the

module and so like the student diaries gave an insight into the longer term effect of the workshops with lecturers reporting on the effect the workshops had on the students work.

Chapter 4. SPD Education within the UK

This Chapter will explore the current state of sustainable product design education in universities, through empirical research studies that build upon each other to gain a fuller picture of provision and best practice in sustainable design within the UK. Initially this Chapter will consider the prevalence of sustainable design terminology in product and industrial design courses in higher education. The subsequent sections will then describe a nationwide survey that was conducted amongst academics that teach upon product and industrial design courses within the UK.

4.1. Sustainable product design education

This section will explore the teaching of sustainable design within product and industrial design courses within the UK. Different institutions deal with the subject of sustainability in different ways from distinctive sustainable design degree titles to specialised modules on existing courses or taught content within an existing module. This content can also vary dependant on the understanding of sustainable design, some institutions will cover only the environmental considerations whilst others will consider all three areas encompassed by sustainable design.

4.1.1. University courses

A review of information provided to potential undergraduate applicants through the UCAS website was conducted, in order to source universities which offered courses in product or industrial design. The course and module descriptions for these universities were then explored to determine which addressed sustainability in design, either as a complete module or as an element of teaching within a module. In total 21 universities in UK were found offering a total of 25 courses in product or industrial design, of which 6 had the term sustainable design explicitly mentioned in their titles. Postgraduate courses at these universities were also explored revealing a total of 12 courses, which considered sustainability in design, of which 5 had the term sustainable design explicitly mentioned in their titles.

A table detailing the universities, course titles, the year that content is taught and whether it is an optional or core element is provided in Appendix A. Further information was made available on the specific content of some of the modules by a small number of the universities but no specific reference was made to the use of sustainable or ecodesign tools. Some university courses may have been missed out from this survey due to the limitations posed by the method used and the information that was available on the website based course descriptions.

4.2. Online Academic Questionnaire

In order to build upon the findings in section 4.1 and gain more detail on the content and teaching of SPD a nationwide online survey was developed as described in section 3.7.1. A total of 38 lecturers responded to the survey representing 29 individual universities. Eleven of the replies were however incomplete and so were removed from the analysis, with the remaining completed questionnaires representing 24 universities; 60% of all those initially contacted. This section will outline the findings of the survey in relation to the questions posed.

4.2.1. Understanding of Sustainable Design

At the start of the questionnaire academics to were asked to define sustainable design in an open question. The results shown in Figure 13 detail the predominant themes derived from the definitions given and suggest that the majority of British academics understand sustainable design in terms of social, environmental and economic considerations, consistent with the definition given at the start of this thesis. This finding is in contrast to the findings of Ramirez's worldwide study (2007b), which found that most defined sustainability in terms of environmental considerations only, which was the position of a third of the respondents in the UK survey.

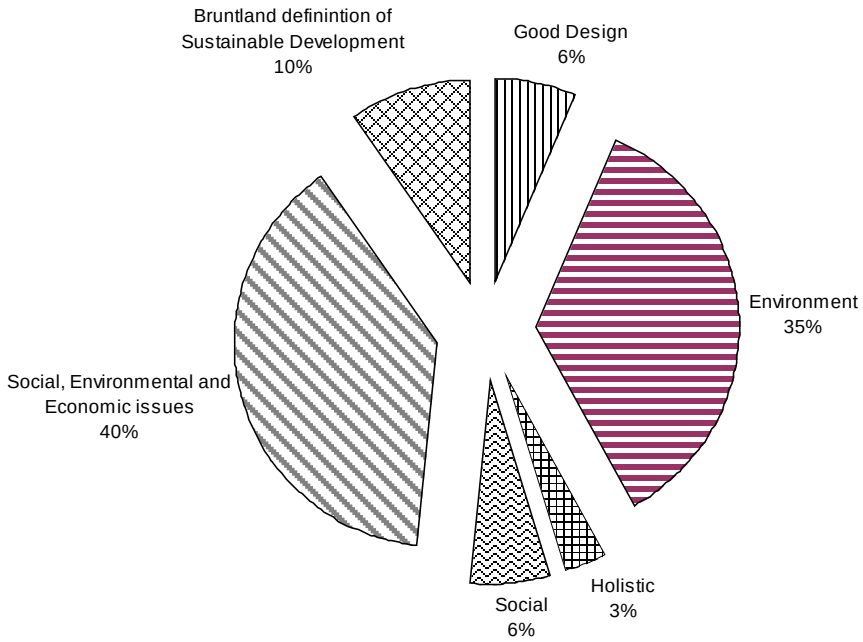


Figure 13: Definition of Sustainable Design

However careful analysis of individual responses found that in all cases where academics defined sustainable design in terms of only environmental issues, they have still highlighted social design requirements in their teaching later in the questionnaire. This could suggest that their definition of sustainable design is only a relative measure in their understanding of the term and cannot be applied to judge the content of their teaching in the area.

4.2.2. Design Requirements

The survey sought to identify design topics that were included in sustainable design as proposed in the literature review. The survey provided academics with a range of environmental and social design requirements, that had been derived from the SD literature (Bhamra and Lofthouse, 2007). Academics were asked to identify those that are currently taught on their courses and then asked to select which design topics ‘could’, ‘should’ or ‘are’ taught on their courses specifically under the umbrella term of sustainable product design. The results are presented in Table 6.

Topic	Currently Taught	Taught through Sustainable Design			
		Could	Should	Are	Total
Design for the aged	21	6	2	16	24
Design for behaviour change	19	4	5	14	23
Design against crime	18	6	3	12	21
Design for disassembly	19	3	6	16	25
Design for the environment	23	1	3	19	23
Design for manufacture/assembly	26	0	3	22	25
Ecodesign	23	1	3	21	25
Emotional design	20	4	1	17	22
Emotionally durable design	14	3	4	12	19
Ethics of design	23	1	4	20	25
Inclusive design	26	1	4	21	26
Product service systems	17	3	4	14	21
Responsible design	18	2	3	17	22
Sustainable design	26	1	4	21	26
Systems design	17	3	4	18	25
Universal design	17	4	3	14	21

Table 6: Design requirements taught through Sustainable Design

The question included environmental and social issues as presented in Table 6, however only the social issues will be discussed here due to the focus of the thesis, but the other elements were used in the publication of the results. All of the 26 academics, who attempted this section, agreed that inclusive design should at least be considered in the teaching of sustainable product design, whilst other design topics varied in response. The lowest response was emotionally durable design receiving only nineteen responses in total. However this lack of response may have been due to a limited understanding of the term, which was specifically commented on by two academics after completing the questionnaire. Similarly a lack of understanding of a preference for a particular terminology over another could have also played a part in the responses. Where possible the research tried to overcome this issue by using different terminology where possible such as universal design and inclusive design which a number of academics rightly pointed out was the same thing. Overall, most of the issues listed were considered by the majority of universities, with a high proportion of respondents indicating that they already include such requirements in their teaching. In response to the research questions in section 2.6.2 the survey demonstrated that a number of socially aspects of

SPD were already taught by more than half of the academics as an aspect of SD including Design for the Aged, Design against Crime, Ethics of Design, Inclusive Design and Responsible Design, however further research will be required to fully address this question and consider how these aspects are incorporated into the students learning experience.

4.2.3. Course Structure

Surveying the year and level at which sustainable design is taught to, 60% of the academics indicated that sustainable design is taught in at least two of the three years of their undergraduate programs as well as the postgraduate program where applicable, whilst 40% only taught sustainable design in the final year of undergraduate or only postgraduate studies.

Respondents were also asked to list the product/industrial design related courses at their institution which included sustainable design teaching. A wide range of undergraduate and postgraduate courses were listed, the most commonly listed was the undergraduate product design program, with no apparent distinction made between the BA or BSc award in terms of sustainability teaching, see table 7.

BA Product Design	14	BDes Other	2
BA Product and Furniture Design	4	BEng Other	2
BA Industrial Design	2	MA Design	2
BA Other	5	MA Other	3
BSc Product Design	14	MSc Other	5
BSc Industrial Design	3	MDes Other	3
BSc Industrial Product Design	1	MEng Other	1
BSc Other	4		

Table 7 Types of courses that incorporate Sustainable Design teaching

Academics were asked how sustainable design content was included in the course content and given five prompts shown in Figure 13, from which they could select multiple criteria as well as adding their own considerations.

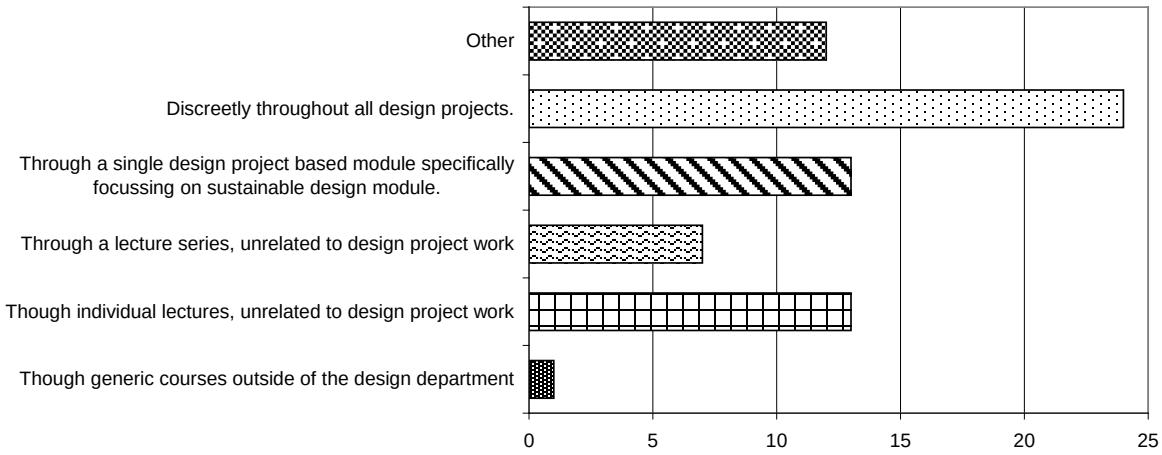


Figure 14 How Sustainable Design is taught within the course

Figure 14 shows that the majority of respondents deliver sustainable design in through design projects, with additional other methods being employed including through contextual studies lecturers that are unrelated to design work. There was only one instance of sustainability being taught generically outside of the design department. Other methods described by academics included teaching sustainability through: the philosophy of product design, optional contextual studies modules in sustainability, focused lectures with knowledge being applied through design projects or discreetly through group or individual discussion in a tutorial or seminar setting. One academic also discussed how sustainability is embedded into the ethos of all teaching at the university through the specialist sustainable futures centre at the university. The above findings show that the majority of institutions represented teach sustainability through more than one method, both in relation to project work and contextually through lecturers.

4.2.4. Staff Expertise

Participants were asked to gauge their personal knowledge of sustainable design by selecting one of five set criteria. Whilst this is a subjective indicator the terminology used endeavoured to ensure the most accurate response. 5 respondents indicated that their knowledge was *'that of a specialist'*, whilst 13 indicated that they felt they had a *'full working knowledge'* and 8 said they were *'familiar with and can grasp the basic concepts'.* No respondents selected *'limited understanding'* or *'no understanding'*, this could be due to the prevalence of the term sustainability

or perhaps indicate that only those who are confident in sustainable design completed the questionnaire.

When asked later about their personal educational needs regard in sustainable design, 2 academics who had stated that they had the knowledge of a specialist, indicated that they would find more detailed resources and guidance helpful. Another 6 academics who stated they had *'a full working knowledge'* indicated that they would find more detailed resources and guidance helpful; 1 indicated that they would like dedicated training and another indicated that they would appreciate guidance on the consideration of social and ethical issues. Other responses included the benefits of being part of the debate on sustainability through external practice and live student projects, as well as attending lectures and conferences to keep abreast of the latest developments. One academic suggested there was a need for training on specific aspects of sustainability, such as the technical details of materials. Overall, the consensus was that detailed resources and guidance to support teaching would be helpful.

4.2.5. Collaboration

When asked whether they formally collaborate with other universities, almost half of the respondents stated they had no links with other institutions, see Figure 15. Whilst a quarter of the respondents mentioned universities with whom they have informal connections. Three respondents cited conferences or seminars where they have collaborated with other institutions, whilst other two respondents mentioned collaborations between different departments within the same university. Finally, two respondents mentioned links with centres such as the Ecodesign Centre Wales and the Centre for Sustainable Futures as opportunities to work with other universities, whilst individual respondents cited links between postgraduate student's research and a working group that had been setup to address collaboration.

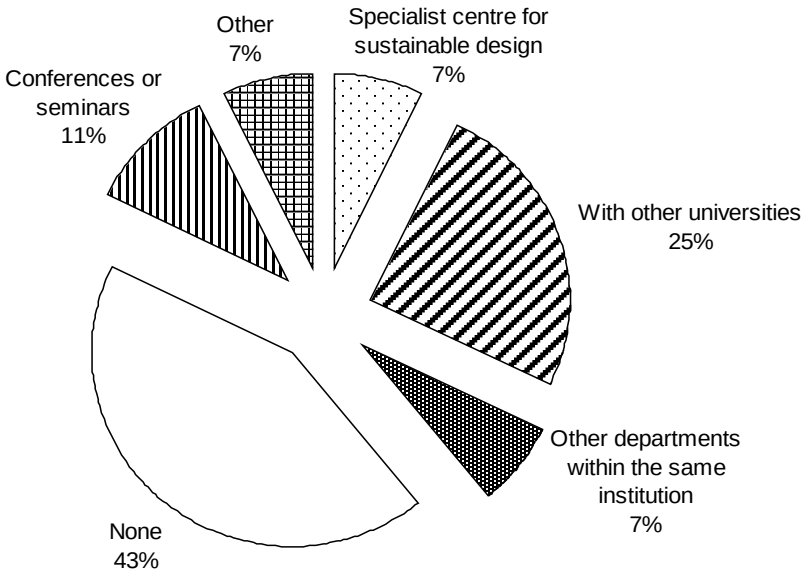


Figure 15 Formal collaboration with other institutions in the teaching of SPD

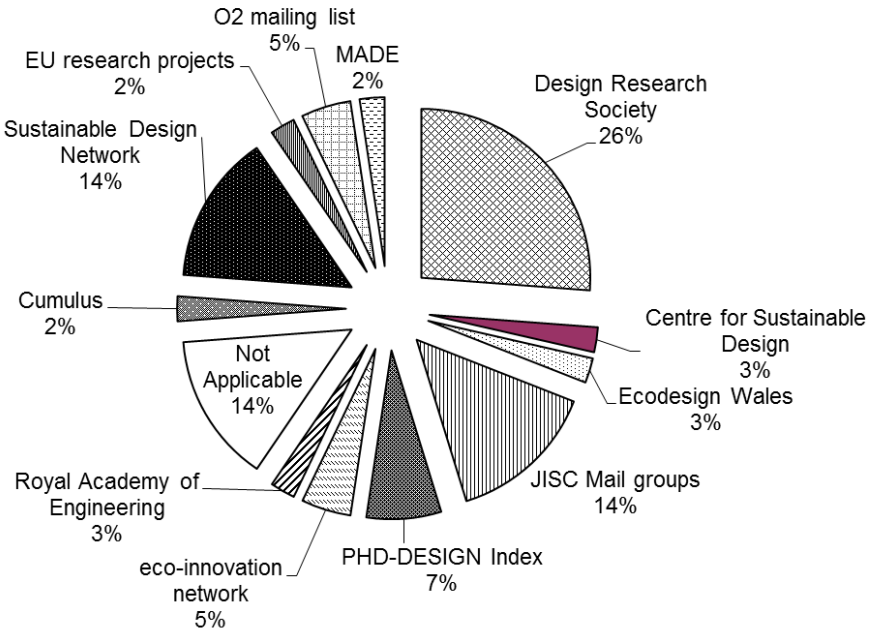


Figure 16 Networks regularly used by academics to network with others

Figure 16 details the informal collaborations through networks which academics regularly use to connect with other academics, suggesting that informal networking is more common than direct formal collaboration amongst the respondents.

4.2.6. Curriculum

The questionnaire findings highlighted a number of common areas of agreement amongst the academics, however the greatest consensus was found in the final question. Academics were asked to select their preferable method for the teaching of sustainable design, by selecting either; *'a specialist optional module'*, '*a compulsory module'* or *'integrating sustainability throughout the core design curriculum as an aspect of good design'*. 97% of the academics agreed that sustainable design should be integrated throughout the core design curriculum as an aspect of good design; with only one academic preferred teaching the subject as a compulsory module. 15 academics felt so strongly about this that they wrote justifications for their stance in the additional comments section. Three academics noted that they were working towards integrating sustainability through all design projects, whilst one noted that while integration is the ideal situation it can be quite difficult to implement.

4.2.7. Limitations of the questionnaire

11 respondents failed to complete the questionnaire, analysis shows that 6 of these respondents failed to complete question 4, which asked for a definition for sustainable design. This suggests perhaps that either these academics had little confidence in their understanding of sustainable design, or that such a question required too much consideration and so may have been better placed towards the end of the questionnaire. One such academic, however, was persuaded by a follow up email to skip question 4 and complete the rest of the survey. 4 academics stopped at Question 5, which required the academics to select design requirements which are taught on their product design courses, whilst 2 academics stopped at question 7 and 12 respectively. The questionnaire permitted the survey to be stopped and returned to at a later date and this was possibly the cause of a number of the incomplete surveys, particularly those questions that may have required academics to give information that may have not been to hand such as question 5. However, this feature meant that the academics

could return to their original questionnaire for completion and was used to some success in reminder emails to encourage academics to complete their incomplete surveys.

An inherent limitation of questionnaires is that the information obtained is limited, however where consent was given a number of academic's comments were followed up via email or later in the further work.

4.2.8. Conclusions

The survey had quite a high response rate; over 40% of all the academics emailed participated, representing over half of all the universities which teach product design in the UK.

The questionnaire findings show that half of the respondents cited a definition for sustainability that noted all three pillars the economic, environmental and social issues, with just over a third referring to only environmental considerations. This is a marked improvement over the previous literature findings (Ramirez, 2007c). Furthermore academics considered a wide range of social criteria as applicable to SPD, further supporting the validity of their understanding of sustainability and helping to refine the boundaries of social SPD. However responses to the social aspects of SPD were limited to the predetermined options offered in the questionnaire and therefore further research will be required to fully define social SPD. It is interesting to note that teaching of the social aspects of sustainable design was even shown amongst those academics who had defined sustainable design only in terms of environmental issues. All of whom indicated that they taught social aspects such as inclusive and ethical design through sustainable design, suggesting that their definition of sustainability cannot necessarily be used to draw conclusions on their knowledge or teaching.

Overall the majority of respondents agreed on the inclusion of a number of social requirements in sustainable design teaching; with all of the respondents agreed that inclusive design currently is or should be taught as

part of sustainable design, whilst 96% agreed that the ethics of design currently is or should be taught as part of sustainable design. This section however also identified areas where there is less teaching in respect to certain SPD criteria this was particularly the case with Emotionally Durable Design (EDD) and to a lesser extent Design against Crime, Design for Behaviour Change and Product Service Systems. A number of lecturers also identified EDD as an aspect they weren't aware of and sought clarification on. Therefore inclusion of such aspects in future research will be considered and if necessary an understanding of less well known topics will be provided.

The teaching of SPD appeared to be common across both undergraduate and postgraduate programs of study, with teaching mostly occurring within project based modules. Selecting the methods through which SPD is taught academics typically chose multiple options however it was clear that the majority incorporate SPD discretely through design project work and projects specific to sustainable design. However such preferences could be related to the project orientated nature of 3D design courses rather than indicating a conscious decision in the way that SPD should be taught. Therefore more detailed further research is required to understand how SPD is taught.

However the whilst the questionnaire gathered a wide range of information, concerning the types of courses, sustainability content and lecturer knowledge and attitudes more detail is required, in respect to the social aspects SPD and how these are taught. The subsequent chapter details deeper research inquiry into the most appropriate teaching, learning and assessment methods, through academic interviews.

Chapter 5. Findings from the Academic Interviews

Nine semi structured interviews were conducted with experts within the field of sustainable design education to follow up key findings of the nationwide questionnaire, the selection criteria for these academics is detailed in Table 4 in section 3.6.1.2. These academic interviews sought to achieve a more detailed understanding of the teaching and learning of SPD, and it was recognised that this could only be obtained through a more personal and detailed data collection method. The semi structured format of interviewing also allowed further issues to be discussed, such as specific programmes of study at individual universities and the opinions and practical understanding of expert practitioners within the field.

As noted in the methodology section 3.7.2.2 the interview responses were coded and clustered into macro code documents, each focussing on a specific area such as definitions of sustainability, the limitations in teaching SPD, course content, structure and learning style employed. However a number of the micro codes within these documents were interrelated or led to discussions on other aspects. For instances limitations in SPD led to discussions on effective teaching methods to address this. Therefore the structure of the following sections reflects this and discusses only the most interesting and useful findings, relevant to the PhD focus. Omitting findings that were unable to be considered within the scope of the PhD, for example comments relating directly to formal assessment methods, as it was recognised that altering assessment methods or criteria would be impractical when working with external institutions.

The findings detailed in the following sections highlight key issues that were identified by the majority of the academics and were described in such a way that they are considered to be important to the effective teaching of SPD.

5.1. Social design requirements

Academics were asked for their opinions on the social aspects that are relevant to SPD, to help identify the social aspects of SPD as highlighted within the research questions in section 2.6.2. Numerous responses were given by the academics with the full list of suggestions laid out as a ‘Wordle’ in Figure 17. A Wordle (Feinberg, 2011) is a computerised method, which presents a graphical illustration of written data with larger words representing those most commonly occurring in the data and smaller words representing those occurring less.

As Figure 16 demonstrates there was a wide range of issues, with a range of terminology used for very similar issues, therefore a number of issues were combined under a single heading to help produce a more concise set of issues to work from. For instance participatory design, co-design, co-creation and stakeholder design were combined and are now represented in Table 8 by a single overarching term ‘Participatory design’. Whilst the researcher recognises that there are slight distinctions between the four different terms, combining the terms helps to clarify the main focus and ensures a more concise definition.

A number of responses were noted by multiple academics including responsible, social and inclusive design, which were noted by 6 of the 9 academics, whilst co-design, participatory and stakeholder design were identified by over half as were issues relating to ethics, community and social wellbeing.

Figure 17 Breadth and frequency of social issues from academic interviews using Wordle

The issues highlighted have been collated in Table 8, grouped under 4 overarching topics that are based upon similarities in focus. These issues will be considered alongside the literature findings in the development of the main study detailed in Chapter 6.

User Centred	Design Values	Societal Concerns	Emergent Fields
Design for the Aged	Design Contexts	Affordable Design	Emotional Design
Appropriate Design	Design Culture	Social Design	Emotionally Durable Design
Design against Crime	Ethical Design	Design for Social Cohesion	Product Service Systems (PSS)
Empathic Design	Design Ideologies	Localisation	Systems Design
Design for our Future Selves	Design Philosophies	Social Equity	
Inclusive Design	Responsible Design	Social Justice	
Design for Behaviour Change	Transparent Behaviour in Design	Design for Communities	
Participatory Design		Design for True Need	
		Social Wellbeing	

Table 8 Social design issues relating to SPD

The findings from this stage are considered alongside the social aspects derived from the literature review to develop the social issues of SPD that are addressed within the 'Rethinking Design Workshops' in chapter 6.

5.2. SPD Teaching and Learning

A number of themes emerged from the interviews regarding the teaching approaches used in SPD education, with academics discussing learning environments, teaching approaches and informal methods of assessment. The following sections will detail the key findings relevant to this study, considering:

- How SPD is best addressed contextually.
- How peer learning is incorporated into SPD education.
- The complex nature of social SPD.
- How deep learning is fostered.
- The use of SD tools and resources and issues arising including the students tendency to compartmentalise their learning and the academics use of SPD terminology.

5.2.1. Contextualised Nature

Academics described how sustainability is best addressed contextually in relation to the student's work, with 4 academics (A5, A8, A4, A6) describing how sustainability is best addressed within the students design projects.

"*A lot of the time they can't see the connections which is really hard so we try to build it into their projects, hammer it home to them that way."* (A5)

These 4 academics described how a project based approach allows them to relate SPD information to students when it is relevant to the particular stage or project that they are working on, whilst two academics cited the studio environment as instrumental in achieving this.

"*But we might outline that (SPD) within a small, 30 minute lecture within a product studio or within a maker studio, you know. … there might be a small workshop on it for instance for maybe half a day. Yeah. So I think probably we do most of these things either project-specific or project by project, seminars, but not really full on."* (A6)

"*Because sustainable design is embedded in all the projects it means that they get to practice thinking along those lines all the time. So it doesn't matter if we are setting a project on a mobile phone or an exhibition stand or design of some furniture."* (A8)

Over half of the academics (A1, A2, A7, A6, A5) cited studios as a means of introducing sustainability whilst 2 academics (A2, A6) specifically described teaching sustainability in the design studio, conducting lectures or seminars in the studio around the students work.

"*But I would say mostly these are taught by studio-based tutors in seminars or lectures within a studio environment."* (A6)

However academics (A1, A4) also identified other methods for teaching SPD such as contextual studies, offering opportunities for written and oral communication in addition to the visual communication in project delivery. Other academics who identified studios also noted using other methods due to limitations in the course structure (A5) or facilities (A7). One academic (A6) was however critical of an approach that didn't relate to the students' own work.

"You've also got a design culture module which actually stretches throughout the whole lens and the thing is if it doesn't touch into these modules, it is really just liberal elitism really. So what you need to do is to make it more democratic and make it more social. You need to actually hit it into what the students are working on at the time and relate it." (A6)

5.2.2. Peer Learning

Academics discussed peer learning in relation to informal peer assessment, peer discussion, debate and group work. All of the academics interviewed cited aspects of informal peer assessment in respect to sustainable design, ranging from peer discussion of students' presentations to peer critique of design projects.

"*Those are the occasions where they have a really interesting cross-discipline peer critique in that almost all our group sessions involve students stand up, make presentations whether it is power point or sketchbook. So that initially is the format how it is run is that students, given the time, stand up and talk for two minutes then peer feedback for three minutes and then a tutor steps in to make his comments."* (A8)

Academics shared examples of rules and guidance they use to help students engage students. Such as giving students post-its to write a positive and negative point for peers project, or stars to indicate a particular strengths in a given area (A4).

“I put up on the board four criteria…….. I mean I give them five stars or five dots each with each colour and you go around and you can give a dot to the best one… and then we stand back and, you know, ‘Who has got five red dots? Right, would you like to explain that idea on that sheet?” (A4)

Another academic discussed how students at both and undergraduate and postgraduate level swap essays to give each other peer feedback (A6). Seven of the academics (A1, A2, A5, A6, A8, A7, A9) described opportunities for students to discuss and give feedback following presentations by peers in a tutorial or design critique format.

“*Almost all our group sessions involve students standing up, making presentations whether it is power point or sketchbook. So that is initially the format, how it is run is that students given the time, stand up and talk for two minutes then peer feedback for three minutes and then a tutor steps in to make his comments.”* (A8)

However one academic (A5) noted reluctance amongst undergraduate students to give peer feedback and another (A7) noted that postgraduate students are gentle in giving peer feedback for fear of reprisals. Two academics (A3, A4) described how formal peer assessment methods were used on group projects to guide individual marks based on each group member’s participation.

Opportunities to engage in peer debate in relation to sustainability were identified by 3 academics (A2, A4, A8). One academic (A4) discussed the use of question cards to help students consider how to reduce the ecological impact of designs. Whilst another academic (A8) described how he gives students opportunities to justify the sustainability of their designs to the local press and public.

Six of the academics (A2, A7, A3, A9, A6, A8) discussed group and teamwork in relation to addressing sustainability. Reasons cited for group

work include encouraging peer discussion, industry expectations on students to be able to work in teams, the sharing of different perspectives amongst students and the ease of managing assessment on live projects requiring a shorter commitment from external clients. One academic (A3) specifically described how peer discussion is particularly beneficial to considering the social aspects of SPD.

"*What is important about the society element is the ability for people to have that discussion as a group particularly, rather than sitting there on your own thinking oh my. It's a sort of thing that leads nicely into small seminar discussion groups where people can bring their products and everyone can discuss their ideas and say, … lets understand it together"* (A3)

Two academics (A5, A8) noted opportunities for students to engage in peer learning through multidisciplinary group projects with other 3D disciplines, including interior, architecture and furniture. One academic (A6) discussed the benefits of a cross year group project between 1st and 2nd year undergraduates. In relation to postgraduate masters students one academic (A6) identified that they often come with different skill sets so they typically buddy students up enabling them to pass on their skills through peer learning.

5.2.3. Complexity of the social aspects of SPD

Three of the academics (A5, A3, A6) cited particular difficulties in the teaching of and students' understanding of the social aspects of sustainability, noting that often students and indeed lecturers find it easier to address the environmental concerns than the complex social issues.

"But it's so hard isn't it, defining the impact of a product in relation to the environment is much easier than saying has someone in society been disenfranchised by the development of this. How would you begin to understand that?" (A3)

One academic noted that the expectations of the students learning experience suits a teacher led transmission approach with measurable outcomes, which suits the teaching of the environmental considerations more readily than the social considerations, which, as the literature highlights, requires a transformative holistic approach.

"Yeah and that's the bad reality of transmissive learning you know they have to have outcomes and have to have something that they can take away a skill or a knowledge and that is when you fall into the environmental trap because it is easiest and it is the less complicated to explain to them." (A5)

Another academic (A3) noted that if design is taught well there should be opportunities for the transformative learning noted in the education for sustainability literature.

"So when design is taught well there is a lot of characteristics there that I think already think are educationally sound they would fit very well with Stephen Stirling's view of transformative learning and ideas about looking outward and making these links and being process rather than outcome focussed." (A3)

This academic also stated that a benefit of transformative learning is that it removes the pressure of an assessed outcome.

"But it's a good learning lesson isn't it because actually if you look at transformative learning it takes the pressure in a way of this idea of an assessed outcome and it puts the experience back into learning this idea that you get what you put into it." (A3)

This academic (A3) noted that social issues cannot be dealt with in the same way that environmental issues are addressed, adding that the scope

of social design is too wide to be addressed in detail within 3 year undergraduate programs.

“In a 3 year curriculum can we possibly hope to cover all these things and I think if we do it as modules then probably not but if we do it in a general discussion about the purposefulness of design” (A3)

(A3) also reflected on how the social aspects of sustainability are more suited to teaching or discussion within the context of a student’s work in a studio or tutorial setting.

Three academics (A9, A5, A3) noted that large student groups limited the ability to teach the social aspects of SPD by restricting the ability to engage in discussion.

“I suppose the biggest barrier is the size of the group because when we first started teaching you might have 40 students which is great because you can work in smaller groups and get a much more collaborative way of learning rather than having to you know use big lectures …. as it has become more popular it has actually become more difficult to teach in the way we want to teach it.” (A9)

Similarly some academics cited small group learning as preferable to a lecture because they permit discussion and allow for group dialogue, fostering greater student engagement.

“*They you know that’s really difficult to get across to a big group its easy in a small group when you can have a nice discussion about it and where you can ask them their opinions and all that sort of stuff and really engage in a dialogue rather than a lecture.”* (A5)

Furthermore one academic (A5) identified a tendency to revert to teaching only the environmental aspects and relying on ecodesign tools when larger groups where involved.

"*but when you have got a bigger group you know I fall back on the environmental ones as tools because I want to know that they have something to take away from the lecture that they have to learn something and the tools are the easiest way to do it."* (A5)

5.2.4. Deep Learning

The academics described a number of approaches that foster deep learning, including experiential learning and immersive learning opportunities and techniques for encouraging critical reflection including questioning techniques and group discussion and debate. One academic (A3) cited small groups as crucial to facilitating deep learning necessary for understanding sustainability.

"*But this sort of route, where we are talking about more deep cognitive understanding of sustainability in small groups, sharing ideas and opinions."* (A3)

Three academics (A2, A3, A8) described deep learning occurring in respect to experiential learning experiences, giving students opportunities to learn through directed field trips or through their practice. One academic (A8) described how they build in multiple opportunities for students to develop deep learning through experiential learning that encourages students to engage with external clients on live projects.

"*They funded us, the students, to design and we help them have this batch of things manufactured. That is actually an experience itself and in terms of learning it is... if you combine sustainable thinking and learning we are trying to use experiential learning as much as we can so instead of talking, doing lectures, students learn more faster, deeper because they are doing and they have... they start to resolve their own project."* (A8)

Immersive learning strategies were cited by 3 academics (A2, A3, A5) who described opportunities including students volunteering in the community, working with local secondary school students to produce furniture (A5) or engaging design students in the development of a community garden space at the university offering an understanding of ecology, biodiversity and user centred approaches.

The use of questioning techniques to foster a critical understanding of sustainability were described by three academics (A8, A5, A2) to help students engage with their own learning (A2) and to encourage students to reflect on their work critically by placing students in the situation where they need to justify their work to professions at sustainable design exhibitions.

"*They have to articulate their view, they have to be outspoken, and they have to engage with debates with the external world. So I think that that is another good experiential learning."* (A8)

Similarly debates were identified by 4 academics (A4, A2, A8, A7), describing group debates in class (A4, A2, A7) or the opportunities for external debates (A8) with the lecturer describing how students participated in a live debate for the BBC in which their work was featured. Academics also described strategies used to encourage students to reflect on their work, including the keeping of student journals considering their consumption (A2) or aspects of their learning on a sustainability module (A5). One academic described a reflective module which occurs alongside the students' major project where they have to consider the impact of their practice in relation to the society, ecology and business (A4).

5.2.5. Use of SD tools

Concerning the use of SD tools academics had differing views on use, with 5 academics not using SD tools in their teaching at all (A7, A8, A3, A6, A1), whilst 3 academics (A2, A4, A5) used tools selectively depending on the particular focus and one cited the wide use of SD tools (A9). However a

number of additional resources were also mentioned including websites and more generic design resources to aid SPD.

Two of the academics (A2, A7) who didn't use SD tools at all in their teaching commented that the largely ecodesign tools offered didn't suit their teaching style or their views on sustainability.

"My themes are quite broad and hard to define but I think for me, it would be useful to give people directions and targets, less easy for them to make subjective qualitative responses to them like this (points at the ecodesign web) because they probably don't have the information they need to do that." (A3)

"*Well it's definitely not here is a tool go use it, it's definitely not the eco-Indicator approach I personally have big issues with that kind of approach because I don't think you can put sustainability in a computer program."* (A7)

SD tools identified by academics were typically ecodesign tools relating only to the environmental considerations of SPD with only one academic (A9) noting a SD tool that could accommodate the social aspects of SPD, the Design Abacus. The ecodesign tools identified included life cycle analysis (LCA) tools such as Sima Pro (A5), Eco-Indicator (Eco IT) (A4, A5, A9), the LiDs Wheel (A5), the ecodesign web (A2, A9) and material selection packages such as Cambridge Engineering Selector (CES) (A5). Additional tools specific to the academics' institutions were also noted including Eco-eight (A2) and personally developed eco-strategy cards (A4).

However 3 academics considered the LCA tools identified to be inappropriate to designers and biased towards engineering (A2, A4, A5).

"I find them very engineering based, design by numbers you know, you tick this box at this stage and then you can move on whereas designers are far more of a fluid organic kind of iterative process where there is going back

and reconsidering you know. So it's kind of hard sometimes to get that through to them, but they do help with decision making." (A5)

"But, to do that, to actually understand Eco IT one has to understand the LCA and LCA is complicated. And again, it goes back to can students in an Arts college understand the underlying science." (A4)

One academic additionally identified a lack of access to computer labs as a barrier to students learning LCA tools, specifically referring to the Sima Pro software (A5).

Another opinion expressed, considered how SD tools may be useful for certain aspects of sustainability such as the environmental impact but irrelevant when considering the more holistic social aspects (A2).

"They don't consider social impacts or useful ways. And the ways that I would use something here might be very different from someone in Africa, for example, my consumption habits. So it's very difficult to take as granted just a number without thinking of all the other things that are behind that." (A2)

Concerning the social aspects of SPD 3 academics (A5, A4, A6) cited different resources including the use of IDEO method cards, noting how they preferred their visual and open nature of the IDEO cards.

"(IDEO) So yeah they use those, they're good I think the visual ones are the best. Yeah anything that is visual just hits you far quicker." (A5)

Describing how they use the IDEO cards with students one academic (A5) noted how they were used in user research giving each student given two cards with research methods to go away and employ, then report back to the class on. Another academic (A6) cited a preference for the open nature of the IDEO cards that permitted different interpretations.

Other resources identified by academics included web based carbon footprint calculators and web based animations such as the Story of Stuff (A4), whilst documentaries such as the inconvenient truth and the 11th hour were also identified as being useful in SPD teaching (A2). Numerous academics described the use of spider diagrams (A2, A4, A5), mind maps (A4, A5, A6) and word circles (A4) to help students explore SPD.

5.2.6. Compartmentalised Learning

Two of the academics (A9, A3) identified a tendency in students to compartmentalise sustainability, addressing sustainability only in the specific module that it is taught, agreeing with literature findings (Ramirez, 2007c).

"*The other thing is the student approach of only thinking about sustainability when they are in the sustainability module. That I would say is the biggest frustration, if you talk to them in other modules they don't like to make the links across but I think that is an indictment of the modular system."* (A9)

It was interesting to note however that in both cases cited above, sustainability was taught in a dedicated module, whilst academics from those institutions where sustainability is more integrated into the curriculum didn't cite the issue.

5.2.7. SPD Terminology

Over half of the academics (A1, A5, A3, A4, A6) cited issues with the term sustainable design or design for sustainability, noting that they don't use it in their teaching as it is often confused or sends the wrong signals to students. One academic noted that students have preconceived ideas in relation to the term (A5), whilst another academic (A3) suggested that the government's use of the term in relation to economic stability confuses matters, similarly another academic (A6) noted that the word is over used and has too many meanings so prefers not to use it.

Alternative terms used by these academics for sustainability included social design (A6), issues (A4) with a focus on students understanding the

underlying issues and coming up with their own definitions (A4) or just relating to the aspects as an alternative way of designing (A5).

"*I'm increasingly coming to the conclusion that it isn't helpful almost having design for sustainability as a topic or if you do you're very clear that it's general and generic and that it is an approach to designing."* (A1)

5.3. Conclusions

A key finding of the academic interviews centred on how small group sizes can benefit the teaching of the social aspects of sustainability, enabling a more specialised focus to explore sustainability more deeply. This was recognised in preferred teaching methods including studio teaching, peer discussion and informal peer assessment which can only occur in small groups. This supports findings in the literature review relating to the benefit of collaboration for education for sustainability see section 2.1.2.1 (Henry-Stone, 2010, Cortese, 2003, Wals and Jickling, 2002, Kelly, 2010, Warburton, 2003) and the group work and learning by discovery preferences of Net generation learners section 2.2.2.1 (Oblinger and Oblinger, 2005a, Tapscott, 2009, Barnes et al., 2007, Howe and Strauss, 2003). A focus on small group based activities will be considered within the development of the main study interventions.

A number of recommendations can be derived from the academic interviews in respect to the teaching approaches and techniques adopted that directly relate to the literature review findings. Academics noted how small groups are vital to facilitating deep learning and noted how deep learning can be fostered through experiential learning and critical assessment. Academics also described how questioning techniques and students debates also recognised in the literature (Griffith and Bamford, 2007) can be used within groups as well as individual students' reflections on their work can encourage critical thinking. Experiential and immersive learning were also noted separately as attributes beneficial to students learning SPD, which supports the literature findings on the benefits of experiential (Huckle and

Sterling, 1997, Cortese, 2003, Henry-Stone, 2010, Wals and Jickling, 2002, Murray, 2011) and immersive learning (Wilgeroth et al., 2008, Gürel, 2010). Such formats will be explored further in the development of the main study interventions.

A few of the recommendations that have arisen agree with both the literature review and previous questionnaire findings but are unfortunately beyond the scope of this research study. Such recommendations include the teaching of sustainability as an integrated aspect of the product design curriculum instead of through a modular approach. Whilst this is an interesting proposal it would require the restructuring of existing courses. However specific recommendations such as the contextual nature of social considerations have potential to be explored further in conjunction with teaching environments such as design studios, small group environments, group work and the nature of peer based learning.

The clarification of social sustainability issues from both the nationwide survey and academic interviews will be considered in collaboration with the literature review findings and will be refined for inclusion in the main study interventions, giving a clear guide to subject content. Furthermore such clarification of social sustainable design requirements is useful in its own right as a piece of research that can be used as a definite source list for others in SPD education.

These academic interviews have further supported the literature findings of Cull (2005) regarding the difficulty in addressing social considerations. In addition to this the findings of this chapter go further suggesting that the nature of the social aspects requires that they are addressed in a differing fashion to the environmental aspects of SPD, using a more holistic approach that encompasses the enlarged nature of the social design field. In relation to this it was interesting that academics had found the IDEO method cards to be particularly favourable due to their visual nature. This supports the literature findings in section 2.2.2.1 which considers how the

Net generation learners are more familiar and comfortable with visual methods (Tapscott, 2009, Oblinger and Oblinger, 2005b), and Murray (2011) describes how images can be used to prompt indirect experiences in relation to personalising sustainability (see section 2.1.3). Therefore the use of visual materials will be explored further in respect to the main study interventions.

Chapter 6. Development of Main Study Interventions

This chapter outlines the development of a number of educational interventions designed to facilitate understanding and the inclusion of social aspects of SPD. These interventions have been designed in light of the findings generated from the academic interviews and the literature review, seeking to develop relevant materials that encourage deep learning, reflection, small group discussion and peer learning.

A total of three separate interventions or workshops were developed and to establish continuity with the students they followed the same format and were grouped under the title the ‘Rethinking Design series’. The workshops were developed to test the findings gathered from all stages of the research study to date, specifically the key teaching and learning findings gleaned from the academic interviews. The key findings that guided the development of the workshops suggested:

- A culturally relevant A/V style to motivate and engage learners.
- A visual approach to suit the learning preferences of students and to aid personalisation by developing an indirect experience.
- Using content that is contextually relevant to the module in question.
- Opportunities for collaborative group work to enhance peer learning and critical reflection.
- The use of questioning to elicit reflection amongst learners.
- Fostering deep learning through critical reflection.
- Enabling learning by discovery a learning preference of students.
- Fostering a holistic approach to enable systems thinking.

Where possible each workshop combined multiple aspects of these research findings. Three workshops were trialled and these are described in detail in section 6.2. The workshops conducted at each institution were selected carefully to best suit the needs of the curriculum and module focus in each university case study. Finally a plan outlining where and when each workshop was conducted is shown prior to the findings from the main case

study being presented in Chapter 7 and four supporting case study institutions presented in Chapter 8.

6.1. Social SPD Issues

A list of social SPD issues was developed from the multidisciplinary literature review described in section 2.5 and summarised as key terms in Table 3; the findings from the nationwide survey as detailed in section 4.2.2; and the findings from the academic interviews in section 5.1 summarised in Table 8. Each of these stages were considered and combined to produce a set of social sustainable design criteria, which informed the content of each workshop.

As described previously in section 5.1 a number of similar social SPD issues were combined to permit a more concise list of topics for exploration in the workshops. Examples included inclusive and universal design becoming inclusive design and transparent behaviour in design and responsible design becoming responsible design. Whilst some issues highlighted within the academic interviews were omitted as they were either too vague, for example design philosophies/ideologies/contexts, or were unrelated to the other issues or just unsuitable for inclusion within any of the three workshops. Examples of such unsuitable criteria included PSS or systems design, which whilst applicable did not complement other issues in either workshop. Design for behaviour change was also omitted, as noted in section 2.5.1.1 because it isn't a focus of this research, but could be explored in further work.

It was decided that the social SPD criteria should not merely be a list of single issues but instead be presented as groups of interrelated issues, which are complimentary and interlinked, echoing the interrelated nature of sustainability. The social SPD criteria used within the 'Rethinking Design' workshops are outlined in Table 9 and are grouped as three distinct introductory workshops.

‘Step into my World’ Design for the other 90%	**‘Localisation and EDD’** Personal Meaning	**‘Exploitation’** Ethical design
Affordable Design	Culturally sensitive design	Affordable Design
Culturally sensitive design	Emotionally Durable Design	Corporate Social Responsibility
Design for Communities	Localisation	Social Justice
Design against Crime	Participatory Design	Social Equity
Design for the needs of the developing world	Wellbeing	Culturally sensitive design
Design for True Need		Responsible Design
Inclusive Design		
Participatory Design		

Table 9 Social SPD design themes

The grouping of these themes was determined by a number of considerations:

- The similarity between specific criteria, with each of the columns in Table 9 outlining the content for one of the ‘Rethinking Design’ workshops.
    - ‘Step into my World’ was concerned with user needs and specifically the underprivileged or other 90%
    - ‘Localisation and EDD’ was concerned with issues surrounding personal meaning and identity.
    - ‘Exploitation’ was concerned with ethical issues in design.
- The focus on a set of issues meant that each workshop could fit more readily into an existing module at the host institutions, ‘Step into my World’ was specifically developed with the module at LSBU in mind as this formed the first institution trial, however the focus additionally suited the modules at NTU and UL because of the user-centred focus.
- The ability to address multiple aspects of social SPD within each workshop, as outlined in the research questions, enabled more social SPD aspects to be addressed within a short period of time. Responding to the academics reflections on the overcrowded curriculum made in the academic interviews.

- The ability to portray the criteria readily through relevant images and music. It would be wrong to suggest that the social issues designated within each workshop were decided by the choice of accompanying music, but the music and images available made it easier to address certain issues together which helped to designate the groupings.

6.2. Rethinking Design Workshops

The 'Rethinking Design series' workshops each consisted of an individual A/V introduction which lasted between 3 - 5 minutes and a group based workshop featuring prompting questions and mind mapping. The choice of these particular elements was supported by the literature, which suggested that the audio visual and group based approach taken with the workshop as outlined in sections 2.2, 2.3 & 2.6 should be beneficial to the students' learning in a number of ways, such as:

- Increased relevance through the use of visual methods used (Oblinger and Oblinger, 2005a, Tapscott, 2009, Windham, 2005) and team work (Howe and Strauss 2003; Oblinger and Oblinger 2005; Barnes, Marateo et al. 2007; Tapscott 2009).
- Encouraging students to be reflective (Albers & Bach, 2003; Hanson, 2002; Tan & Pearce, 2011) and personalise aspects of sustainability through indirect experiences (Murray 2011) by using carefully selected photographs.
- Improved learning through combining complimentary multi-modal methods of learning (Crowther, 2012; Moreno & Mayer, 2000; Park & Hannafin, 1993)
- Group work that builds opportunities for discussion, debate and critical reflection as well as engagement (McNerney and Davis 1996; Huckle and Sterling 1997).

The following two sections will consider the development of the A/V introduction and workshops in more detail.

6.2.1. Audio Visual (A/V) Introductions

The A/V introductions were developed as a method of introducing the topics to the students and to enable them to start considering and reflecting on the topics. The A/V presentations were contemporary in style using photographs

and music as noted in the literature in 2.3.3, such an approach was used to capture the students' attention, deliberately mimicking internet based media content such as You Tube, where images or silent video are overlaid by a piece of popular music. Such a style was adopted so that the A/V material was more readily relevant to the 'Net Generation' audience, who are described as able to weave text, images and sound in a natural way (Oblinger and Oblinger, 2005). Ensuring that the A/V introductions were relevant and contemporary in nature was an important consideration, as the introductions sought to foster deep learning by motivating students, as recognised in the literature through the use of culturally relevant learning materials that related to real world issues (Fransson, 1977, Ramsden, 1997) (Marton and Säljö, 1997).

The A/V approach as noted in literature also encourages participation in group discussion (Ahlkvist, 2001; Albers & Bach, 2003; Martinez, 1995) and is an opportune format for introducing complex new themes and topics (Ahlkvist, 2001; Albers & Bach, 2003; Brkich, 2012). The photographs used were intentionally selected to portray a number of different aspects echoing the well-known Chinese proverb, "one picture is worth ten thousand words", so that each A/V introduction could introduce a much larger range of social issues than a traditional lecture format could accommodate, if only at superficial level. The use of photographs was also chosen as the literature findings note the use of photographs for understanding social realities (Hanson, 2002; Harper, 1988; Hraba et al., 1980; Schell et al., 2009; Wagner, 2002), as well as noting the importance of thoughtful interpretation (Perkins, 1994) and reflection (Hanson, 2002) of photographs, whilst Murray (2011) suggests that the use of images can elicit an indirect experience for the personalisation of sustainability.

Therefore an A/V approach was chosen to support the 'Rethinking Design' workshops. In total three A/V introductions were developed with supporting materials. These introductions accommodated a number of different social sustainability criteria that were identified in section 6.1 and sought to create

a learning atmosphere that is conducive to deep learning, reflection, peer learning and small group discussion, which were all areas outlined in the research findings as beneficial to teaching and learning in SPD. The specific development of each introduction is described individually in the following sections.

6.2.2. Workshop Activity

Each A/V introduction was followed by approximately 5 minutes of individual reflection to foster thoughtful processing and reflection (Hanson, 2002; Perkins, 1994) before commencing a 40 – 50 minute small group discussion and brainstorming session, which was supported by a few prompt questions similar to the method described by Hanson (2002) in section 2.3.2.

The students were grouped with only 4 - 5 individuals per group so that each individual would have an opportunity to participate and engage in discussion. The use of small student groups also recognised a key finding from the academic interviews in section 5.2.3, which found that the social aspects of SPD are difficult to teach in large groups because large groups restrict the ability for students to engage in discussion, suggesting that small group sizes are preferred and are also more conducive to deep learning. In addition by grouping students in this way the researcher was able to deliver the workshops to varying class sizes across the different institutions, but still maintain the same small group dynamic and benefits of small group work, which were reflected upon positively by the students.

The prompt questions used within the group session shared a similar format across the workshops with the first two prompts noted below remaining standard across all three workshops with different third and fourth questions dependant on the specific content.

- The first prompt asked students to reflect individually, writing brief notes on what the A/V introduction made them think of in relation to design and their project: i.e. problems, solutions or ideas that

immediately sprang to mind. The students were typically given 5 minutes to collect their thoughts.

- The second prompt asked students to form groups of 4-5 individuals and share and discuss their individual responses to the A/V introduction, noting down the group's responses in the form of a mind map. This typically took 15 minutes.

This format replaced a typical formal teaching approach, with the researcher and lecturers present, only to facilitate learning and discussion by questioning. This approach was designed to encourage peer learning, small group discussion and deep learning by requiring students to reflect critically on the material presented.

Throughout the duration of each workshop students were asked to make notes and produce mind maps charting their group discussions and thinking. Mind maps were encouraged as a quick method for the students to note down their thoughts and aid reflection. Mind maps also permit the students to work in a more fluid way so that the noting down of their thoughts didn't detract from or interrupt further reflection and finally the mind maps allowed students to document their thought visually using text, graphics and sketches as they saw fit.

The researcher recorded these interactions through photography and the use of Dictaphones to capture the discussion and aid analysis. Each A/V introduction was piloted before use on undergraduate and postgraduate students within the Design School at Loughborough University. Each workshop was modified accordingly upon feedback. The A/V introductions were self-contained units selected according to the curriculum requirements at each university.

6.2.3. 'Step into my World'

'Step into my world' was the first A/V presentation and the shortest at less than 3 minutes. It incorporated a user focussed bias addressing aspects

under the ‘design for the other 90%’ banner. It portrayed a number of emotive images of different types of people with differing needs and cultures see Figure 18. The images used were selected to represent the diversity in society and typically individuals that are less privileged; the other 90%. Therefore the images presented elderly individuals, a disabled man, an ethnic lady in traditional dress, a youth in an impoverished area and a happy young man in a different country.

The song ‘Step into my World’ (Hurricane #1, 1997) was selected as the lyrics describe the notion of stepping into someone else’s very different world in order to understand and relate to them, emphasising empathic UCD approaches, such as co-design. Therefore the presentation introduced themes broadly under inclusive design, including design for true need, design for the other 90%, co-design, social design, design for the aged and design for disability. This user-centred focus ensured that the workshop fitted well within the product design curriculum and therefore was relevant and engaging, meeting a key requirement for the fostering of deep learning (Fransson, 1977, Marton and Säljö, 1997, Hounsell, 1997).

As noted in section 6.2.1 the introductions were followed by prompts and questions to structure the group based workshops. Following the generic prompts a final set of questions was posed to help the students apply their thinking and reflections to their projects or a traditional design approach by considering:

- ***Who*** are the target audiences/end users you have identified?
- ***How*** would you consider/address their needs?
- ***Where*** in the design process would you begin?
- ***What*** are True Needs?
- Can you think of good ***existing examples*** that meet needs you have identified above?
- ***Why*** are these people’s needs not currently met?

The students were given 20 minutes for these final questions.

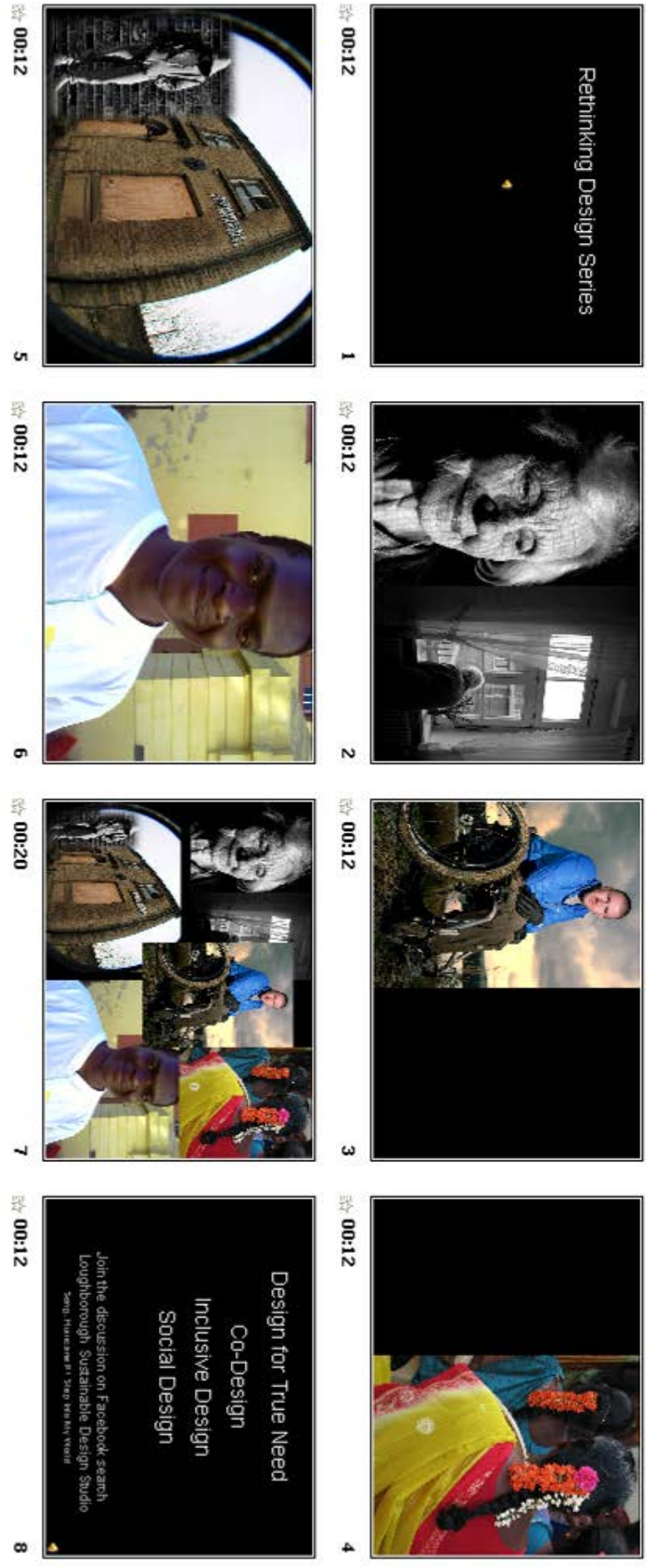


Figure 18 Slides from Step into my World A/V introduction

6.2.4. Localisation, Emotionally Durable Design and Reuse

The ‘Localisation and EDD’ workshop was the second in the series, however the A/V introduction differed slightly in structure to ‘Step into my World’ by additionally containing text, which was required to facilitate understanding and demonstrate the principle behind key images that might not have been fully understood in isolation. The introduction was 4 minutes long and covered localisation, end of life considerations, emotionally durable design, personal meaning, personalisation, product reuse, secondary product life, cultural identity and employment as demonstrated in Figure 19.

A dramatic piece of instrumental music ‘Heat Miser’ (Massive Attack, 2006) was chosen as it suited the environmental slant of the introduction through the suggestion of the use of breathing apparatus. The piece of music also grabs attention and so encouraged engagement and concentration during the introduction. Although this introduction had an environmental issues slant through the way that it dealt with products, underlying social themes ran throughout the material presented addressing employment, affordability and individuals’ interactions and relationships with products.

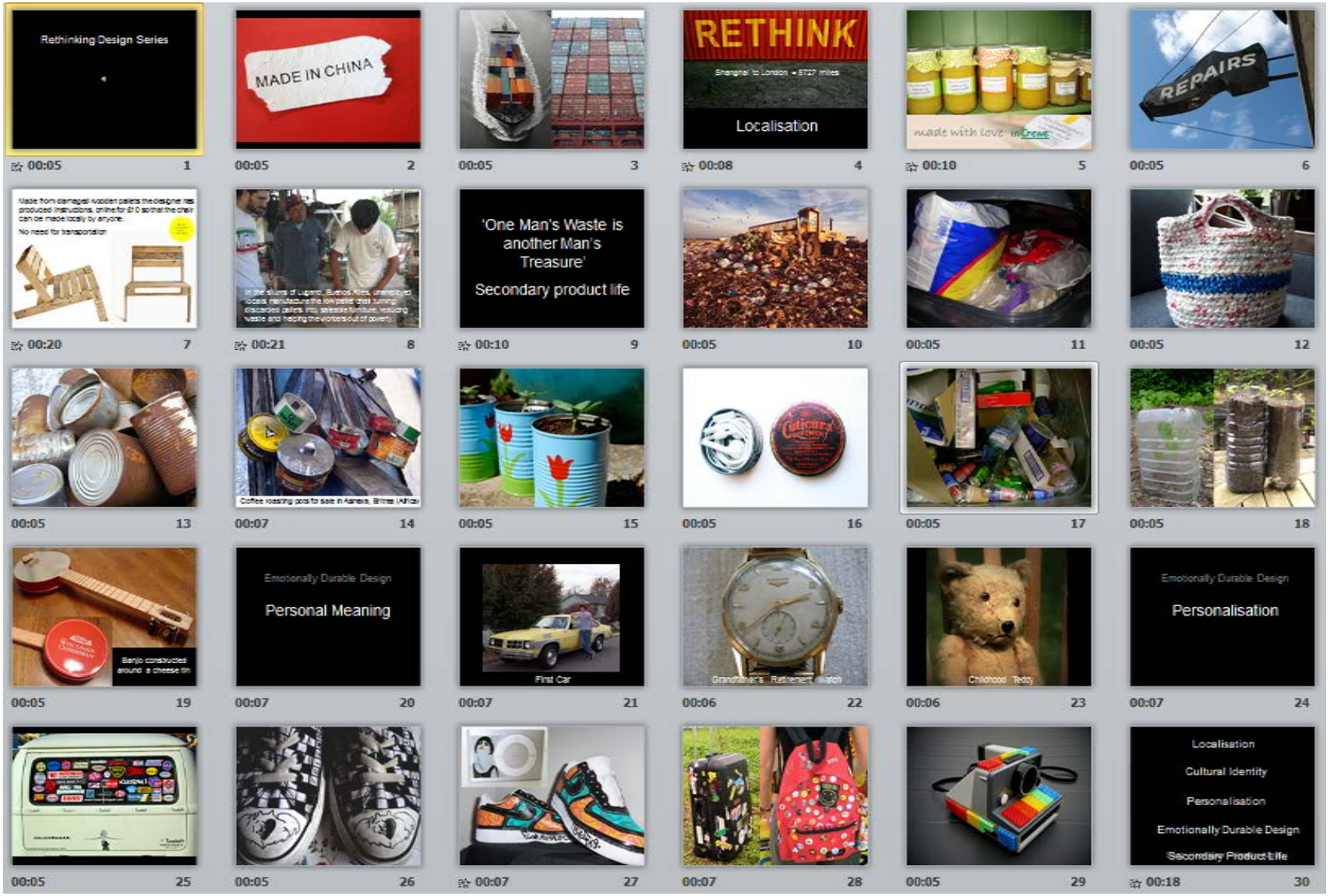


Figure 19 Slides from Localisation and Emotionally Durable Design A/V introduction

As noted in section 6.2.1 the introductions were followed by prompts and questions to structure the group based workshops. Following the generic prompts a final set of questions was posed to help the students apply their thinking and reflections to their projects or a traditional design approach by considering:

- Whether they relate to any of the Emotionally Durable Design aspects presented personally and share examples with their group.
- Whether they considered what was presented as feasible or not.
- If they knew of any existing examples which addressed the areas outlined in the presentation.

These questions alongside the generic prompts were structured to measure the students' response to the A/V materials, determining what they identified and how they related to them. The purpose of the final question below was to help the students apply their thinking and reflections so far to their projects and a traditional design approach.

- How they could relate the issues and themes they had been exploring to their design projects? Combining any one or a combination of themes in your project and reflect on how such approaches could benefit society as well as the environment including societal attitudes to waste and the environment.

6.2.5. Exploitation

The 'Exploitation' workshop was the third in the series and like the 'Localisation and EDD' workshop also contained additional text based quotes. It was also the most holistic in content, addressing issues such as exploitation, social justice and equity, ethical consumption and design activism. The introduction considered a number of case studies, which addressed child labour, inequality, pay and workers' rights and conditions as shown in Figure 20 below and was overlaid by a piece of music called 'Get Cape. Wear Cape. Fly.' (Duckworth, 2006a), which discusses the effects of western consumerism on individuals in the developing world.

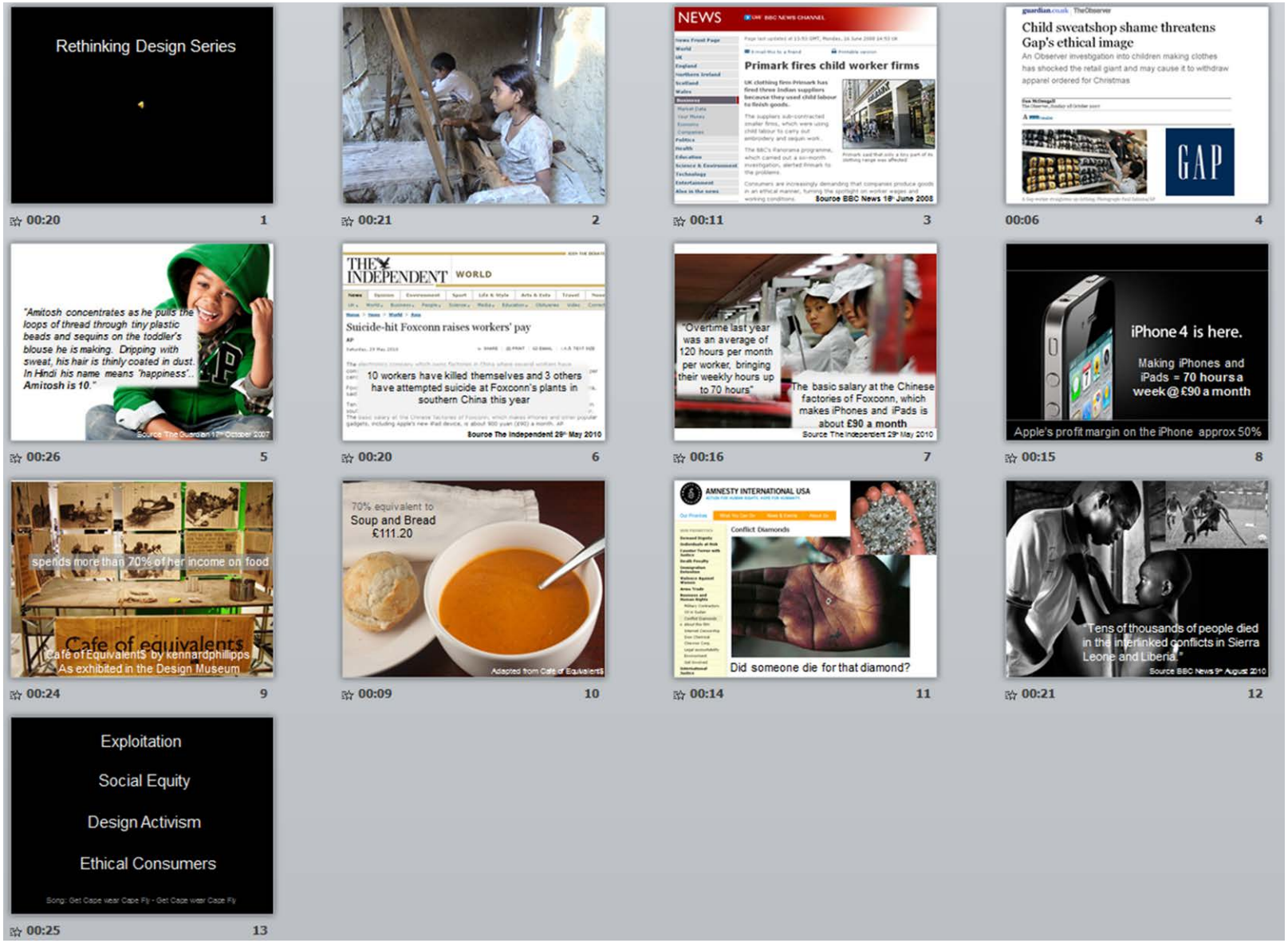


Figure 20 Slides from Exploitation A/V introduction

Although the content of the introduction is not directly relatable to designing a product, the introduction addressed issues that exist because of the demand for designed products and relate to designers' responsibilities, fairness, ethical dilemmas and global citizenship, helping students to grasp the holistic nature of sustainability as recognised in section 2.1 and the globalised market of which designers have influence.

As noted in section 6.2.1 the introductions were followed by prompts and questions to structure the group based workshops. Following the generic prompts a final set of questions was posed to help the students apply their thinking and reflections to their projects or a traditional design approach by discussing:

- How relevant the issues raised by the presentation are to designers?
- How designers could address them?
- Whether they consider such issues to be the norm when designing for the global market and something that can't be changed?
- Whether they know of any ethical examples, products or brands that address the issues portrayed in this presentation?

These questions alongside the generic prompts were structured to measure the students' response to the A/V materials, determining what they identified and how they related to them. On the other hand the final questions below encouraged students to respond personally and reflect on how they can make an impact as an individual.

- Students were asked to consider their own stance on exploitation and how they could, as an individual citizen/designer, begin to address or seek to improve some of these issues represented in the presentation?
- Students were also asked how to ensure that the needs of people in developing countries are considered in design?

6.2.6. Selection of images

Images were selected to portray certain aspects pertinent to delivering the multiple aspects of social SPD as intended in each workshop. Images were chosen carefully to elicit reflection in order to help create the indirect experience that Murray (2011) alludes to, as important in promoting the personalisation of sustainability.

The number of images used differed according to the workshop and the type of information or reflection that was required. For example, only 5 images were used in the ‘Step into my World’ workshop, however each image was carefully selected to highlight at least one underrepresented sector in society for example, the elderly and disabled, whilst other images such as the woman in a sari could have elicited multiple interpretations including ethnic minorities, faith groups or women in different cultures. These images were also shown for a lengthened duration to the point of unease to encourage students to think thoughtfully as Perkins (1994) describes.

The images were selected to promote reflection and the researcher was careful to avoid bias in the choice, deliberately seeking to choose images that didn’t represent stereotypes, for example deliberately choosing a young sporty wheelchair user (‘Step into my World’) who was happy and appeared outgoing and independent.

6.2.6.1. Selection of music

The music sought to support the visual content or convey additional meaning through the lyrics or style of the music, adding to the context of the visual material and supporting a multimodal learning experience. The visual content of the ‘Step into my World’ and ‘Exploitation’ A/V introductions was hung off the message and lyrics of the selected music. However, this is not to suggest that the content of the workshops was driven by each piece of music; rather music was chosen that specifically suited the social aspects identified for inclusion and added to the message of each workshop. Both pieces of music used in ‘Step into my World’ and ‘Exploitation’ workshops

enabled this, however difficulty arose in the selection of music for the 'Localisation and Emotionally Durable Design' workshop as the researcher couldn't find a piece of music containing lyrics that permitted the breadth of issues to be addressed.

The researcher considered a number of pieces of music linked to the environment or consumerism, in particular 'Sleeping in', a piece of music that highlighted the ignorance and apathy towards climate change in the West (The Postal Service, 2003) and 'Whitewash is Brainwash', a piece of music that was critical of consumerism (Duckworth, 2006b). However the researcher decided the messages were either too subtle to have engaged students, potentially risking confusion, or too specific to the environmental or the consuming of goods and therefore couldn't address the multifaceted nature of sustainability effectively. Therefore an instrumental piece of music was chosen for the 'Localisation and EDD' workshop to give a sense of urgency in addressing the issues involved and to maintain the continuity of the audio visual element in the series.

6.2.7. Conducting the Rethinking Design Workshops

All three workshops were trialled in different combinations at a number of universities (see Table 10). Trials were chosen were possible to compliment the module teaching at each institution but were also dependant on the availability at each institution. Where multiple trials were conducted they were conducted in the order given below.

Institution	Step into my World	Localisation, and EDD	Exploitation
London South Bank University	October 2011	December 2011	X
Northampton University	X	X	December 2011
Nottingham Trent University BSC Nottingham Trent University BA	February 2011 X	March 2011 March 2011	X X
University of Limerick	March 2011	March 2011	March 2011
University of Wales Institute of Cardiff	X	March 2011	March 2011

Table 10 Workshops schedule by Institution

Three institutions UL, LSBU and NTU include additional findings from the workshops in the form of lecturer interviews regarding the effectiveness and repeatability of the workshops. Whilst it would have been ideal to interview staff from all five institutions, this was not possible as the researcher was limited by the availability of staff and conducted the workshops at two institutions without the presence of the usual module lecturers.

The workshops were conducted at different intervals depending on the universities involved as shown in Table 10 there was a two month gap at LSBU and a month gap between the workshops at NTU, whilst the workshops were conducted on consecutive days at UWIC and back to back all on the same day at UL.

In total 11 workshops were conducted across the five universities and the findings from these are detailed in the following Chapters 7 for the main case study and Chapter 8 detailing the supporting case studies.

Chapter 7. Main Case Study Findings

As described in sections 3.2 & 3.6.1.3 the 'Rethinking Design' series workshops were conducted in five universities. All three of the workshops were conducted at the University of Limerick, however due to availability, access and time constraints it was not possible to conduct all three workshops at the other four universities. Therefore this chapter describes the findings from the in-depth case study at the University of Limerick (UL), whilst Chapter 8 details the findings from the four supporting case studies at the UK institutions, which allow for comparison and generalising of the findings for the rest of the UK.

7.1. Description of the course at UL

The following section will describe the student cohort that participated in the 'Rethinking Design workshops', as well as the course type, module title and form of assessment. Information derived from the module and assignment guidance will also be considered alongside findings from an academic interview from chapter 5 that relates to the course in question from the key academic teaching on the module in question.

The course is a BSc in Product Design Technology, which is a 4 year undergraduate program with a 6 month industry placement. Environmental sustainability isn't formally introduced until the third year and is taught through a technical module that is jointly delivered with engineering students. However aspects of responsible design are included informally in the 1st and 2nd year through studio projects briefs and are addressed holistically rather than through applied teaching. In the first two years of study students are typically asked questions pertinent to their work, to coax out responses relating to responsible practice rather than through formal instruction. Previous cohorts of students had addressed design for society contextually in the second year of study. For example the previous cohort of second year students had been involved in a community project that involved working with secondary level students on a design project in a local

school. However the cohort of students involved in the ‘Rethinking Design’ workshops hadn’t engaged in such a project, therefore the workshops were a good opportunity to offer this consideration of design for social issues.

The course is structured so that the first year of study is dedicated largely to skills training, the first semester of the second year to the process of design and the second semester of the second year to philosophy and thinking in design, which is where in the course the workshops were conducted.

7.1.1. Module, cohort and workshop description

The ‘Rethinking Design’ workshops were delivered to 35 2nd year BSc students on a contextual design module called Contemporary Design Culture. 33 of the 35 students involved where from Ireland whilst 2 were international students from Finland and Argentina. The assessed outcomes of this module were:

- A final essay worth 35%.
- A personal diary worth 25% to be kept by the students throughout the module.
- A design debate and design challenge project each worth 15%.
- 10% for professionalism and participation throughout the module.

The focus of the module and the essay questions were varied, typically fitting within the criteria of a contextual studies unit. The 12 week module featured four guest lectures, which focussed on: Slow Design in week 2, Design for Society in week 6, Irish Design in week 8 and an unknown topic in week 9. A weeklong interdisciplinary project with sculpture students was included between weeks 3 & 4, exploring aesthetics and interpretation. Workshops were also included on new technologies in week 5 and the ‘Rethinking Design workshops in week 7. The module also included a study trip to Lisbon in week 10, debates in week 11 and support tutorials for the essay in week 12.

All three ‘Rethinking Design’ workshops were conducted on the same day in week 7, with students completing the workshop questionnaires directly before the first workshop and immediately after the last.

The findings considered the following responses to the ‘Rethinking Design Series’ workshops:

1. Individual student responses through both of the questionnaires.
2. Individual student responses to each of the A/V introductions.
3. Group responses to each of the workshops through audio recordings and mind maps.
4. Responses to the workshops in the students’ diaries where applicable as it was the student’s choice as to which aspects of the module they commented upon.
5. Lecturer interview

The ‘Rethinking Design’ workshops covered different themes to the rest of the module, although the week 6 Design for Society guest lecture also considered the social dimension of design. The Design for Society guest lecture was given from the perspective of a designer and his work with Designers without Borders designing floatation devices for local Fishermen in Uganda. Therefore the guest lecture didn’t overlap with any of the ‘Rethinking Design’ workshops and therefore couldn’t be considered to directly impact the outcome of the workshops directly. However the guest lecture could have potentially indirectly primed the students to the need for considering the needs of the wider user groups which was a focus of the 1st ‘Rethinking Design’ workshop ‘Step into my World’.

7.2. Relating the findings to the Research Questions

The following sections will explore how the findings from the ‘Rethinking Design’ workshops relate to the research questions as detailed in section 2.6.2 by considering how the students responded to the following aspects of the workshops:

- The appropriateness of the style of the ‘Rethinking Design series’ workshops including the A/V nature of the introductions
- The effectiveness of the workshop format including the A/V introductions and subsequent group based questioning and mind mapping.

- The ability for the workshops to enable students to consider and address multiple social SPD aspects.
- How the workshops impacted on the students work as judged from the lecturer's responses.
- Attitudinal changes amongst students in relation to the workshops.
- Ability of the workshops to foster deep learning responses.
- Evidence of the positive impact of group work.
- The ability to foster individual and group reflection.

7.2.1. Understanding the evidence identifiers

Due to the large volume of analysis material, evidence identifiers have been substituted for direct quotes. These identifiers relate to the appropriate transcriptions, mind maps, diaries and individual responses to which the findings relate. Individual responses are derived from the student's response to the workshop before commencing the group work and their responses to the open questions in the final questionnaire. The individual responses have been numbered according to each individual student; this number corresponds across all individual responses the student has made in the workshops, questionnaires and diary entries where applicable. An explanation of each identifier is given below in Table 11 and examples of documents that the identifiers relate to can be found in separate Appendices L – U.

D1a	Diary One sheet A
IC-1	Individual Contribution – Student identifier
E1M	Exploitation Workshop – Mind map Group 1
E1T	Exploitation Workshop - Transcript Group 1
L1M	Localisation and EDD Workshop – Mind map Group 1
L1T	Localisation and EDD Workshop - Transcript Group 1
S1M	Step into my World Workshop - Mind map Group 1
S1T	Step into my World Workshop - Transcript Group 1

Table 11 Explanation of main study document codes

7.3. Findings regarding the Audio Visual (A/V) methods

The A/V introductions were designed to enable students to engage quickly with a number of social sustainability criteria. The use of a visual approach that utilised modern music to emphasise the core message was intentional to produce an experience that the students engaged with. The following sections explore findings relating to student feedback in respect to the audio visual nature of the introductions.

7.3.1. Audio nature

Despite music being used in all three workshops, students only commented on the music used in 'Step into my world' and 'Localisation and EDD'. The students commented positively in respect to the inclusion of music and made links between the music and the visual content (S1T)(IC-21).

Students also discussed the nature of the lyrics in relation to the song used in the 'Step into my World' introduction, which had the same title and described stepping into another person's world. These lyrics were effective in triggering discussion and thinking and led to a variety of user centred empathic research approaches (S3T/7M/8M) being suggested including ethnography (S3T) and co design (S4M), as methods for learning about other cultures such as those represented in the A/V introductions.

"Lyrics of the song – take a step in my world, this suggests living in one of these peoples shoes for a day". (S1M)

7.3.2. Visual nature

The use of images and the visual nature of the audio visual introductions were noted amongst students in the diaries, questionnaires and the workshop sessions with students describing the *'striking'* nature of the photographs and composition *(D1/3/9).* Another student commented that: *'it was the wonderful selection of photos that made me stop and think' (D8a)*.

“Quite beautiful pictures, aesthetically all were nice, even though they would be considered unprivileged groups of people, they were all happy.”(IC-17)

Some students commented on specific images used in the presentations with a number of students describing the disabled young man and the elderly lady that were included in ‘Step into my World’. (S1T/D6/D11/IC-20/5/6/23)

“Lovely mood in the photo with the elderly - I think there is a clear sense of boredom, inside the window. A design/activity is needed.” (IC-5)

A number of students also cited examples of items from ‘Localisation and EDD’, including the pallet chair, earphone tin and the flower pot made from a reused food can as examples that they were particularly inspired by. (L2T/3M/5M)(IC-18/27/13)

“Earphones tin aesthetically cool and useful” (L3M)

Students also began to relate the examples given in the A/V introduction personally; contextualising aspects such as emotionally durable design, personal meaning and reuse by citing objects that they have an affinity with (L2T/7M).

Similarly the images of the Chinese factory workers and child labour in the ‘Exploitation’ A/V introduction appeared to be particularly memorable and were cited by several students, with comments describing the cramped conditions in particular (D3/11) (IC-13/14).

Whilst it was typically photographs from the A/V introductions that were cited, a number of students also recalled text based quotes from the materials, such as *“One man’s waste is another man’s treasure”* in the Localisation and EDD A/V introduction: (L2T/D9) (IC-6/16/12/13/5). Students

also recalled the figures quoted in regard to the hours worked and wages paid to the factory workers (E1T/1M/8M/D6)(IC-21).

7.3.3. Effectiveness of the workshop style and format

UL students discussed the effectiveness of the audio visual introductions in their diaries. In particular students responded positively to the style of the A/V introductions, citing the short length (D1) and simplicity (D8) of the A/V introductions, alongside comments describing the thought provoking nature (D10) and ability to evoke discussion (D1/3/8/9/10/12). The A/V introductions also provoked an emotional response in cases amongst students who commented on how they found them *'powerful'* (D8) and in the case of the 'Exploitation' introduction *'shocking' and 'upsetting'* (IC-21) (E1T/D3/D8/D9/D11).

One student cited 'Step into my World' as less effective than the other two (D9). Whilst 'Exploitation' generated the largest discussion and the most divisive debate amongst the students, considering issues such as; the responsibilities of designers (E1T/2T) and opposing views on the use or need for child labour (D1/5/12), as well as the merits of methods for addressing the issues portrayed such as raising social awareness (D1/2).

The creative and applicable nature of 'Localisation and Emotionally Durable Design' particularly appealed to students due to the inclusion of existing examples. Students cited the workshops as enjoyable and beneficial, whilst describing how the workshops had helped them broadened their thinking and outlook in respect to their design solutions (D2/3/5/8/10).

"Overall I thought the workshop was very beneficial as it opened my mind to looking beyond the obvious problem and look deeper into the situation to come up with a good solution." (D2)

Students also cited the group work and group discussion aspect of the workshops, recognising the benefits such as the consideration of different opinions and viewpoints (D6/8/10/11/12).

"We then broke off into groups and discussed what we thought of the videos. We had to group with people we don't normally group with which was quite good because we saw different opinions" (D10).

One student as quoted below noted that the group work element of the workshop was particularly beneficial to his learning, echoing the literature in section 5.2.2.1 which suggests that the current generation of students find a peer-peer learning approach more credible than a teacher learning experience.

"I felt that the group discussion was an excellent approach to the learning outcomes. It is in my opinion that students learn more from each other if they carry out projects in groups." (D9)

7.3.4. Ability of workshops to introduce a range of social aspects of SPD

Students identified a number of social criteria from each on the workshops related to age, cultural diversity, employment equality, ethics, exploitation, inclusivity, need, poverty, responsibility and wellbeing. Whilst the acknowledgement of some of these social issues should be a given considering the context of the A/V introductions, it was how the students reflected upon what linked the social issues together that demonstrated a grasp of the social sustainability content. Students drew parallels between different groups particularly in the 'Step into my World' workshop (D2/5/10).

'The first presentation had images that were all connected by their different/ marginalised circumstances.'(D5)

Students also linked the content of the 'Step into my World' A/V introduction to design deriving the need to design for all (D5/8/9/12)(IC-20/27/14/19/8), design for the underprivileged, minorities, other 90% (IC-15/1/24/26/5/23/14/21/12) and to design for need (IC-23/1/18/19). Recognising the need for inclusive design, students also noted the

differences and barriers due to culture, age, ability and language (D12)(IC-24/23/21/8) as well as the connectedness (D2/5/10/12) of the individuals portrayed in the A/V introduction.

'I felt this workshop was interesting because it made me think about these issues from a designer's perspective.' (D11)

Students also demonstrated how they could link the various social issues to design possibilities (D2) and solutions.

'The first images we were presented with, elderly, disabled, disadvantaged areas presented us with a new kind of design brief. One where a product would be based mainly on its function and need, not aesthetics or modernity' (IC-6)

Within this consideration of the different social needs of others, students began to discuss how they could now see the individuals' needs from different perspectives (IC-20/24/23). Whilst some students described how they felt unable to understand or comprehend the situation individuals as presented in the A/V introduction were in because they either had no experience of it (IC-23) or it was so different to their own situation (IC-26).

This observation from the students of the need to be aware of other's needs, led students to discuss user research methods that could be used with the individuals portrayed in the A/V introductions noting how empathic design methodologies (IC-26) such as stakeholder design (IC-26/14), and ethnographic research (IC-24/27) could be used in conjunction with the different groups presented. Students also explored how design can be a positive agent in social change and used to build community (D10).

Responding to the 'Localisation and EDD' & 'Exploitation' workshops, students recognised the complexity of social sustainability when discussing locally produced goods as an alternative to the global economy, recognising

that this would negatively affect workers in developing countries that depend on the global trade for employment (D11). Students concluded that design could in fact be used to address problems in traditional ways addressing needs as well as non-traditional ways such as raising awareness and redesigning systems.

In the 'Exploitation' workshop students suggested various means of tracing the origin and history of a product to encourage accountability and transparency applying design thinking and systems thinking to the problem (E2T).

7.3.5. Lecturer's view on the impact of the workshops

Discussing the impact that the workshops had upon students, the lecturer stated that the workshops had increased her students' understanding of the topics introduced.

"Well the module isn't typically taught as sustainability as such as I feel that word can be quite a dirty word these days and they are formally taught sustainability in the 3rd year, but it definitely increased the students understanding of the topics introduced."

When asked about whether there was a visible impact from the workshops in the students' work, the lecturer noted that it was too early to tell.

"Difficult to say at this stage as the module is still on-going but this would be apparent form the journal comments and the essays at the end of the module April 18th submission date."

However the lecturer had noticed students applying aspects of the workshops in another studio based module, describing how one student in particular had applied learning from the Localisation & EDD workshops, referencing customisation in design concepts for a jewellery box to encourage emotionally durable design.

The lecturer also noted that the workshops had successfully introduced students to multiple aspects of sustainability, and enabled the students to bring the different aspects explored throughout the three workshops together.

"Yes I think it did, I think the students were aware of some of the aspects but putting the names to them helped them make sense of it and bring it together."

Discussing the format of the workshops the lecturer noted how the A/V introductions could have additional information for lecturers on specific images used to allow the workshops to be easier to deliver autonomously by academics in their own institution.

"Yes but I think the lecturer will need to have some understanding or maybe some notes or a recommended reading list to support the presentations with additional examples so that they can use them to facilitate discussion with the students."

This was particularly beneficial as this lecturer had successfully run the workshops autonomously at UL on their own, testing one of the considerations of their design, whilst the supporting studies the workshops had been run by the researcher.

7.4. Evidence of attitude changes amongst students in response to the workshop materials

The student questionnaires contained two key questions, which were repeated on both questionnaires and sought to measure any attitudinal changes as a result of the trials. The first asked students to rank in order of priority 10 generic design issues including 4 with a social bias. Two questionnaires were conducted one at the start and another at the end of the workshops to permit comparison and attitudinal and learning changes. It was found that students had adopted a more positive attitude toward social

issues with students consistently ranking affordability, ethics, inclusivity and usability as higher priority than they had in the initial questionnaire. Conversely product purpose, market and aesthetics showed the greatest reduction in priority between the two questionnaires.

Students were also asked to select from 6 statements, 1 which best described their approach to the design process, however this question proved to be too ambiguous with only 7 out of 34 students changing their preference. Four of these changes could be attributable to the social impact of the workshops as two further students each marked the following criteria:

- (e) a passion for addressing the needs of the underprivileged and two further students cited
- (c) addressing currently unmet needs.

Students also noted changes in their attitudes in the open response question at the end of the questionnaire. The responses were mostly related to the ‘Exploitation’ workshop; noting key issues such as:

- how designers need to consider the long term impact of a product and the effects it may have on people (IC-1),
- a recognition of the responsibility a designer has (IC-17)
- the designer is as much involved in the injustice as the worker (IC-10).

In relation to the ‘Localisation and EDD’ workshop students recognised that design doesn’t have to be new (IC-5), recognising the potential for a second life of products.

However it was the diaries that provided the greatest understanding of students’ attitudes and the changes attributable to the workshops, with students choosing to describe attitude changes in their own words. These students demonstrated how they had personified and contextualised issues portrayed in the A/V introductions, considering their responsibilities and opportunities as designers (D5/6/8/10/11) and consumers (D1/2/3), whilst

also contextualising how the situations and the individuals portrayed related to their own lives (D1/3/5/6/11).

"The worst aspect was showing the examples of the products they make. It reminds us that products that give us pleasure and enjoyment were made in these environments." (D9)

Students also noted how different their cultures were and how lucky they felt as a response to what they had seen (D11).

"I had never even thought about how lucky we are to live in a society with social welfare." (D11)

Students commented on how they were moved by the examples of products that they take for granted being made by exploited workers and having no insight into the hardship involved (D3/11).

"But this got me thinking about everything I use every day. How do I know the letters that I pound whilst I type this out was not placed by an 11 year old girl or a father with 4 kids struggling to put food in their mouths working 16 hours a day for next to nothing." (D1)

Students also related what they had seen to their future outlook, with one student noting that they wouldn't want to work for the companies involved in exploitation (D11), whilst a number commented on the eye opening nature and their changed focus as a designer (D6/10/11).

"It showed me that as a designer I have an obligation to use the talent and career that I have been given to help others." (D6)

7.5. Evidence of deep learning within the social aspects of SPD amongst individual students

The literature review demonstrated a link between deep learning, collaboration and critical reflection therefore the following section will also consider how these attitudes featured in the analysis of the student workshop experience.

7.5.1. Evidence of reflection, discussion and students own perspectives and insights.

Analysis of the workshops was undertaken as four separate stages, initially analysing the questionnaires and individual responses to the A/V introductions, followed by the group discussion transcripts, group mind maps from the workshop and the individual student diaries. A particularly interesting finding across these four stages is the change in the level of student understanding throughout the different stages.

Individual responses to the introductions were predominately observations relating to the content of the individual A/V introductions noting images, people, objects, situations and how these can be addressed in respect to design. Students also interpreted and attempted to relate what they had seen to their understanding. There were a few examples of genuine reflection (IC-23/6/21) of which one is included below:

“Each picture represented to me a section of our communities showing the people who need it most such as the elderly, shown in grey and black colours (lonely drab), the wheelchair man in the mud, the council estate (poverty) and the images of people from another background. I feel it shows the need to design for people we need to help the most while they are the people we have no experience of.” (IC-23)

Such examples of reflection in the individual responses were initially limited in their scope but the student responses later benefited from the group discussion where design thinking approaches were discussed and the

students grew in confidence recognising that design thinking could be used to address the issues identified in new and creative ways. In addition to the lack of reflection within the individual responses, there was no evidence of design thinking or deep learning. In essence the individual student responses were typically surface level interactions with the content.

However the group based discussion and workshop exercise featured greater consideration of the material with students exploring the A/V introductions at a deeper level, with a number of observations consistent with deep learning. Students engaged with aspects at a personal level as well as engaging in critical reflection, discussing the designer's responsibilities and the complexity of child labour in developing nations as well as suggesting approaches which foster design thinking principles. Areas detailed above including group work, reflection and design thinking will be explored in more detail in the following sections.

7.5.1.1. Group work

UL students cited in their diaries that the group work and group discussion within the workshops, encouraged them to consider different opinions and viewpoints (D6/8/9/10/11/12). One student in particular noted that the group work element of the workshop was particularly beneficial to his learning by offering a peer-peer learning environment.

"I felt that the group discussion was an excellent approach to the learning outcomes. It is in my opinion that students learn more from each other if they carry out projects in groups." (D9)

Students reflected on the conflicting views that arose within the group discussion especially in relation to the workshop on exploitation (D5/8/12). These students recognised that there were often two viewpoints or arguments to a particular issue, for example when considering the exploitative labour in developing countries through the 'exploitation' workshop, students recognised that whilst inequality of low wages, long

working hours and child labour was wrong, it still provided much the workers with much needed employment (D5/E2T). This suggested that the students had grasped important characteristics of the complexity of sustainability through critical reflection.

The students' learning also continued beyond the group based workshop exercises, with the individual student diaries demonstrating even greater amounts of reflection and critical reflection. Students demonstrated a grasp of design thinking and even reflected on the workshop tools by discussing the reflective benefits of completing the second questionnaire. Such aspects are explored further in the following sections.

7.5.1.2. Questionnaire Reflection

In their diaries students noted that the questionnaires, conducted at the start and end of the workshops had elicited reflection. Students initially reflected upon the questions identifying aspects that they didn't understand and also on the purpose of the questionnaires (D4/5/7/9/10/12).

"The purpose of the survey was to determine how much every student understood about design. In my opinion, this was a good start to the workshop. It helped me to determine what I needed to know after finishing the workshop." (D9)

These students later reflected on how their thoughts, perceptions and knowledge had changed through the course of the workshops, comparing their responses in the final questionnaire with those in the initial questionnaire (D2/5/9/10).

"After the workshop we were then asked to fill in the same survey as we did before the workshop. This was interesting because my thoughts and knowledge of the aspects had changed or broadened. The videos and subsequent discussions had broadened my thoughts on the power of designing, that as well as functionality, aesthetics and a message, a design

can have social benefits and bring people closer together to help make people's lives better." (D10)

The students also typically found that the questionnaires were beneficial to them because of the ability to reflect upon what they had learnt, which was an unexpected outcome as the questionnaire was initially intended solely as a data collection and measurement tool.

"After watching the video and discussing the topics, we all had to complete a second survey individually….. I believe that this was an excellent way to end the workshop. It showed how much we learned from the presentation and the difference from what we knew at the start." (D9)

7.5.1.3. Reflection

The time taken for students between completing the three workshop sessions and writing up their diaries enabled them to reflect further and combine their thoughts on all three workshops into a personal account of their experiences and reflections upon the activity. The student diaries noted how the workshops, 'Exploitation' in particular, caused them to reflect upon the decisions that they make as consumers as well as designers (D1/3/6/11).

"I'm still not sure yet if 1 area in particular takes my interest but I would love as a designer to help disadvantaged people if I can" (D6)

A number of the students reflected upon what they saw, personalising aspects of sustainability by contextualising what they saw in terms of their own lifestyle (D1/3/5/9).

"The worst aspect was showing examples of the products they make. It reminds us that products that give us pleasure and enjoyment were made in these environments." (D9)

Students began to reflect upon and unravel the issues that underlined some of the issues explored within the workshops, beginning to question macro themes such as globalisation and mass production (D3/6/11/12).

"So maybe it is fair to ask if there is a need to mass produce items on such a large scale with such negative outcomes." (D6) (A student's concluding diary remark)

Students also reflected on more specific issues such as the effect of technology growth upon communities such as the elderly (D8)(S2T/3M):

"Technology is getting more and more sophisticated with every day that goes by but as we improve technology are we complicating things for different people in society." (D8)

In response to the 'Step into my World' A/V introduction students recognised social issues related to a lack of community, with a few students noting loneliness as an issue related to the images of the elderly individuals. (S1T)(IC-5/6/19).

However students also identified positive attitudes of individuals in the introduction, also noting how the disabled individual and young man from a developing country demonstrated or made them feel an appreciation for life (S1T/3/5M)(IC-17/6/19/27).

Students also endeavoured to relate the workshop content to design, considering how design approaches could address the issues raised. In particular, they discussed design for need (S2T/1/6M)(E2T) and how design for all isn't always possible, instead discussing designing for groups of people (S1T) and identifying cultural differences relating to age, ability or ethnic origin (S2T/2/3M)(E2/3T) (D3/5). Students also differentiated between the need to design for 'needs and not wants' (S3M)(IC-26/14/24).

In their diaries students also reflected upon how their own preconceptions of what design was, had changed (D6/8/10).

"I thought about how a simple design or idea can have a big impact. Not on a consumer of an item, but on a community or a way of life. It made me really think about the power of design, as well as the responsibilities of designers to stay relevant and that as well as being fashionable or popular, that design has an important message, or in this case an important cause." (D10)

The students also considered whether design was responsible for the issues portrayed and what the responsibilities were or should be upon designers (D6)(E1/3T/3/6M) and whether they can be expected to be responsible for the effects of their products past the design stage, particularly in manufacture and at the end of life (D8/11)(E1/2/3T/2/4M).

"It showed me that as a designer I have an obligation to use the talent and career that I have been given to help others" (D6).

Expanding on the issues of responsibility students highlighted the need for and potential approaches to address consumers' awareness (E1/3T/1/2/8M)(IC-15/17) and societal attitudes and values that are wasteful and harmful to the environment and society as a whole (E1/2T/1/8M)(IC-20).

7.5.1.4. Design Thinking

Evidence from the student's diaries, and group workshop discussion demonstrated that design thinking had taken place (D1/2/5/10/11). Students sought to use their creativity and knowledge to resolve issues outside of the remit of the traditional designer. Design thinking did occur in the 'Step into my World' workshop (S2T) but was most prominent in the workshop on exploitation (E2T/3M). Students questioned how they could address the issues, suggesting solutions that raised consumer awareness including

labelling on products that would enable consumers to trace the product in a similar way that meat in Ireland can be traced.

"We first looked at the Irish beef market where you can trace meat from farm to fork and thought the same process could be employed in the manufacturing industry each material and component could be traced back to a country and company of origin making every link visible in the chain." (D1)

Students also discussed corporate transparency, which would require manufacturing outsourcing in the developing world to become a public procedure promoting transparency and good practise.

"Doing business in this public theatre would hopefully guide companies to a higher moral ground in fear of being shunned by consumers." (D1)

In addition to students adopting design thinking skills, students also began to consider and discuss the need for a redesign at a systems level to address the issues (D5/6)(E2/3T).

"As designers we start a brand you know something that goes on the product showing it has been sourced and something that has a complete database to back it up showing it has protected sources." (E2T)

7.6. Ability to address multiple aspects of social sustainability

Each of the workshops portrayed multiple social sustainability criteria derived from the literature and academic interviews and developed in section 6.2. These social sustainability aspects were reflected in all four stages of the student's response to the workshops, with references being noted to numerous different criteria within each workshop.
From the 'Step into my World' workshop students considered:

- Inclusive design and design for all specifically noting the elderly and disabled.
- Design for need, design for the other 90% and the underprivileged.
- Community issues including isolation and deprivation.
- Cultural diversity, including different ethnicities, faiths and languages.
- Importance of wellbeing and quality of life.
- Empathic design research strategies such as ethnography and user centred design.

From the ‘Exploitation’ workshop students considered:

- Addressing the needs of the underprivileged.
- Exploitation including child labour and poor working conditions and hours.
- Inequality including poor pay in respect to living costs and OEM’s profit margins.
- Designers’ responsibilities and the ethics of design.
- Design thinking strategies raising consumer awareness of unethical practices, enabling transparency through a product tracking system and engaging with the agencies involved to bring about change.
- Design for social wellbeing and affordability.

From the ‘Localisation and EDD’ workshop students considered:

- Emotionally durable design and its attributes including attachment, personal meaning and personalisation
- Localisation, including the benefits to the environment and society as well as potential drawbacks
- Design thinking strategies such as enabling traceability through labelling to promote localisation
- Reuse including the cultural implications and the link to affordability
- Social wellbeing through community and sustainable living

Students also began to look for connections between the content. This was particularly evident in the ‘Step into my World’ workshop, where students sought to make links between the individuals (D2/5/10/12)(IC-20/17).

‘From the first set of slides I came to the conclusion that although each slide had very different people in very different situations they all had one connection and this was designing for a particular social group.’ (D2)

Students also began to carry across learning or content from one workshop into another building upon prior learning, continuing to discuss issues relating to the previous workshop such as labelling that would enable product traceability, the ethics of mass production and fair pay, demonstrating links between the ‘Localisation and EDD’ and ‘Exploitation’ workshops (L1T/1/4/8M).

‘Nice to know where it comes from – we then know how it is made.’ (L6M)

7.7. Conclusions

Student feedback in the questionnaire and diaries positively acknowledged and recognised methods used within the workshops, particularly the audio visual style of the workshop introductions. Students also appreciated the opportunities to engage in group discussion and even commented positively on how the questionnaires had unintended benefits, enabling the students to plan for and later reflect upon the workshops.

The A/V nature of the workshop introductions proved to be effective, engaging the students as well as being memorable, as demonstrated by students reciting exact quotes and accurately describing detail in images. Moreover the audio in one workshop (in particular ‘Step into my World’) led students to a deeper exploration of the content to explore empathic design research approaches. More importantly the A/V introductions were engaging enough to foster group discussion and debate amongst the students. It was this discussion and debate in the workshops that was found to have instigated critical reflection and deep learning that was initially absent in the students’ individual responses. Individual student reflection was also later evident in the follow up questionnaire and diaries.

The approaches used in these workshops enabled students to explore multiple social sustainability aspects within a short space of time. The workshops were successful in addressing a range of social sustainability criteria and encouraging students to consider such issues in respect to their discipline. Whilst the workshops addressed a number of social sustainability issues, it was the students who reflected upon how these related to their practice considering issues such as a designer's responsibilities. This was prompted by the workshop questions, whilst other findings such as the range of design thinking solutions were derived and driven entirely by the students in response to identifying needs from the A/V introductions.

The impact of the workshops upon student's attitudes was difficult to measure from the questionnaire responses, however individual statements from a number of students' diaries and open response sections in the questionnaire revealed that the workshops had an impact on the students personally and professionally with three in particular describing how it has changed their focus as a designer.

Chapter 8. Supporting Case Study Findings

This chapter describes findings from the supporting case studies conducted at the four UK Universities. The findings from these institutions are considered in relation to the in-depth main case study at the University of Limerick. The 'Rethinking Design Series' workshops were again used at each institution and the findings were collated from the student questionnaires, lecturer interviews and the mind maps and audio recordings of the student interactions within the workshops. These supporting studies intend to allow for comparison and generalising of the findings for the rest of the UK.

8.1. Description of cohort and course by institution

The following section will describe the student cohort that participated in the 'Rethinking Design workshops' at each of the UK institutions as well as the course type, module title and form of assessment.

8.1.1. London South Bank University

The workshops conducted at LSBU were delivered to 26 2nd year BSc students. The students that made up this sample were varied and included 4 international students and 8 mature students. At this particular institution discussions with the academic staff, including responses from the academic survey, a review of the module guides and lecture materials, academic publications and assessment of student submissions enabled a detailed picture of the students experience to be collected.

Two 'Rethinking Design' workshops were delivered on a compulsory design studies module called Design Studies 2. Each workshop was conducted in a different project and during the research stages prior to students commencing the conceptual design phase.

The first workshop, 'Step into my World', was conducted during a 'Design for All' a group assessed project which considered aspects of human need such as inclusive design, human centred design and ergonomics. The

students had been given 10 areas from which they could choose one as a focus;

- Health Care and Wellbeing at home or in hospitals, home care and GP's
- Mobile and Digital communication or cross generational communication
- Living and working in the built environment, domestic environment, at work or shopping
- Leisure considering social activities or sports
- Travel public or private transportation

The assessed outcome was a group conceptual design project.

The second workshop 'Localisation and EDD' was conducted during 'Reduce, Reuse, and Recycle' an individual student project with a purely environmental focus where students were asked to use LCA guidelines to redesign packaging for a luxury food item or cosmetics, clearly demonstrating the redesigned item benefits in comparison to the original. The assessed outcome was a redesign and modelling of packaging with the intention of reducing its lifecycle impact by referring to calculated LCA data.

The students in the cohort had studied aspects of environmental sustainability in their 1st year through two modules 'user centred design' and 'digital communications'. The user centred design module had focused specifically on the use of materials considering the use of bio plastics and the potential for the reuse of waste stream materials, exploring the properties of a waste material and possible joining methods. The second module 'Digital Communications' set a brief for the students to raise awareness on campus by communicating environmental impact, with the aim of reforming attitudes to the use of electricity and water within the university (Andrews, 2010) and included a visit to a Sustainable Design exhibition at the Design Museum.

The two questionnaires were conducted at the start of the module and again on assessment day at the end of the module, approximately 4 months apart.

The findings from LSBU considered the following responses:

- Student responses to both of the questionnaires.
- Group responses to each of the two workshops in the form of mind maps and transcripts.
- Lecturer interviews
- Work submitted at the end of the projects

8.1.2. Northampton University

The 'Exploitation' workshop conducted at NU was delivered to 14 2nd year BSc students. The cohort typically consisted of local students including one international from China and one mature student. A workshop was delivered in a compulsory contextual studies module, called 'Design for the Real World' and was conducted in the final week of the module prior to the students submitting the assessed essay outcome.

This module explored the responsibilities of designers in response to numerous issues including standards, intellectual property, branding, ethical, environmental and global issues and assessment was through an essay addressing the following question: "How does a designer design for the next generation". A list of lectures for the module suggest that the students would have had a least a basic introduction into some of the social issues surrounding SPD through the consideration of ethics, designer responsibilities and design for the needs of the developing world as a case study on the wind-up radio had already been conducted and the students evidenced knowledge of this in the workshop mind maps. The exploitation workshop was chosen as it contained the most relevant to the lecture entitled 'Design in the Global Market' which the workshop replaced.

The lecturer for the module had previously indicated in the academic survey detailed in Chapter 4 that sustainability was taught throughout the 1st, 2nd and final year of study at undergraduate level and that sustainability is integrated throughout the curriculum with the contextual studies module

closely linked to the studio projects. The researcher also visited the university prior to the trial to observe the culmination on a design for the developing world project undertaken by another lecturer with the same cohort of students in their 1st year of study to design sub $1 shoes for India (Schaber, 2010).

Two questionnaires were conducted at NU. The first was completed a week before the workshop and the second immediately after the workshop, ensuring that all students present gave feedback. The findings from NU considered the following responses:

- Student responses to both of the questionnaires.
- Group responses to the workshop in the form of mind maps and transcripts.

8.1.3. Nottingham Trent University

Nottingham Trent University (NTU) provided a different perspective to the other workshops as it gave the opportunity to measure the effectiveness with 1st year BA and BSc students. The research had previously not involved 1st year students in the workshops as it had been assumed that 1st year students wouldn't have a significant enough grounding in the fundamentals of product design. This assumption centred on the nature of the workshops, which questioned aspects of the traditional understanding of product design, hence the title 'Rethinking Design'. This therefore required the students to be first grounded in the traditional design process, including manufacturing and user research. However, these workshops granted the opportunity to explore and question such preconceptions and judge the effectiveness of the trials with 1st year BSc and BA students.

Two 'Rethinking Design' workshops were conducted amongst 17 BSc students 'Step into my World' and 'Localisation and Emotionally Durable Design', whilst the latter was conducted with 49 BA students.

The BSc cohort contained two international students from Ghana and Greece, whilst the BA cohort had 11 international students from Hong Kong (4), China (4), Indonesia (1), Korea (1) and Jersey (1) as well as a Welsh student. Two questionnaires were conducted at NTU with the two different groups. With the BSc students the questionnaires were conducted directly before the first workshop and after the second workshop, which were held 5 weeks apart. The BA group completed the two questionnaires directly before and after the only workshop.

Both the BSc and BA students were undertaking a yearlong Design Practice module; however the module was distinct to their course and the studio project based sessions were held and taught separately, with the BSc students undertaking more technically focussed project briefs.

The BA student experience occurred in a large studio environment with a number of different tutors due to the large size of the cohort. The students were completing a professional practice element of the module at the time the ‘Rethinking Design’ workshop was conducted. The BSc module was based in a small teaching room and taught by the course leader only. However both groups were undertaking design projects at the time the ‘Rethinking Design’ workshops were conducted.

The BA workshop was delivered across the course of a morning in three settings to accommodate all the students. This occurred within a carousel format whilst the two resident lecturers led two other sections. The workshops were incorporated as part of a professional practice design project for which the assessed outcome was a group redesign project considering of a more appropriate use for components derived from a cheap consumer electronic product of the groups choosing. Therefore the inclusion of the Localisation and EDD workshop was pertinent as it considered issues surrounding reuse which was the key remit of their design brief and this was noted towards the end of the workshop when students began to attempt to apply their workshop learning it to their projects.

BSc students were undertaking two different projects on the two dates that the workshops were conducted. The first involved a packaging project when the ‘Step into my world’ workshop was conducted and the students were undertaking a commercial project centred on engineering runners and sliders. So neither project was particularly related to the workshops focus in this case.

The module guides for both courses suggest that neither the BA nor BSc had received specific prior teaching in respect to sustainable design, which is typically introduced in the second year of study on both courses through Design Studies and in the final year of the BSc course as indicated by an academic’s response in the nationwide survey. However the module guide for the BA course suggests the students had undertaken a reuse project earlier in the year and had been introduced to ecodesign techniques but not the social considerations of SD through the current project.

The findings from NTU considered the following responses:

- Student responses to both of the questionnaires.
- Group responses to each of the two workshops in the form of mind maps and transcripts from the audio recordings.
- Lecturer interview

8.1.4. University of Wales Institute of Cardiff

University of Wales Institute, Cardiff (UWIC) like NTU, offered a different perspective to the workshop trials, enabling them to be tested with higher level MSc students to test whether the workshops were relevant and applicable to postgraduate students. The researcher was particularly interested in whether the workshops could accommodate a greater breadth of learning and provide a challenge to higher level learners. Another benefit of including UWIC in the study was that it permitted a greater consideration of Welsh students in the main study, adding to the generalizability of the findings. However the UWIC workshops also involved three international

students from Egypt, France and Belgium providing a more representative postgraduate audience.

The workshops were included in a module entitled ‘Sustainability Issues in Design for Production’, which was assessed through a group based design project. The brief that had been given to the students on the day that the first workshop Localisation and EDD was conducted was to design an innovative product or use for a waste stream material generated from a large local recycling centre. On the same day prior to the workshop delivery, the students had already received teaching on Product service Systems and guest lecturers from the Ecodesign Centre Wales considering a number of eco assessment methods which were debated. Therefore there was a strong focus on the environmental aspects of sustainability and a good level of understanding of these. The Localisation and EDD workshop lasted 45 minutes whilst the Exploitation workshop conducted the following morning lasted two hours. It could be suggested that perhaps the Localisation and EDD workshop may have gone on longer had it not been conducted at the end of a long teaching day for the students.

Ascertaining baseline data on the students is more difficult than with the other institutions as these were postgraduate students from different undergraduate courses in different countries, prior to undertaking the MSc at UWIC. Whilst data was collected in the academic questionnaire see chapter 4 from an academic at UWIC only two of the postgraduate students in this study were also undergraduate students at UWIC.

The findings from UWIC considered the following student responses:

- Student responses to both of the questionnaires in the form of mind maps and transcripts.
- Group responses to each of the two workshops.

8.2. Understanding the evidence identifiers

Due to the large volume of analysis material, evidence identifiers have been substituted for direct quotes. These identifiers relate to the appropriate documents where the evidence to support the claims is made. The transcriptions, mind maps, and questionnaire responses. An explanation of each codes type is given below in Table 11 and examples of documents that the codes relate to can be found in separate Appendices L – O.

NE1M	Northampton University - Exploitation – Mind map Group 1
NE1T	Northampton University Workshop - Exploitation - Transcript Group 1
CL1M	UWIC – Localisation and EDD – Mind map Group 1
CL1T	UWIC – Localisation and EDD - Transcript Group 1
CE1M	UWIC – Exploitation – Mind map Group 1
CE1T	UWIC – Exploitation – Transcript Group 1
LS6M	London South Bank - Step into my World - Mind map Group 6
LS1T	London South Bank - Step into my World - Transcript Group 1
LL1M	London South Bank – Localisation and EDD – Mind map Group 1
LL1T	London South Bank – Localisation and EDD – Transcript Group 1
T1S2M	Nottingham Trent University BSc – Step into my World - Mind map Group 2
T1S1M	Nottingham Trent University BSc – Step into my World – Mind map Group 1
T1L1M	Nottingham Trent University BSc – Localisation and EDD – Mind map Group 1
T1L3T	Nottingham Trent University BSc – Localisation and EDD – Transcript Group 3
T2L1T	Nottingham Trent University BA – Localisation and EDD – Transcript Group 1
T2L3M	Nottingham Trent University BA – Localisation and EDD – Mind map Group 3
T1Q	Nottingham Trent University individuals Questionnaire comments

Table 12 Explanation of main study evidence indentifiers

8.3. Findings regarding the Audio Visual (A/V) methods

The A/V introductions were designed to enable students to engage quickly with a number of social sustainability criteria. The use of a visual approach that used modern music to emphasise the core message was intentional to produce an experience that the students would engage with. The following sections explore findings relating to student feedback in respect to the audio visual nature of the introductions.

8.3.1. Audio nature

Despite music being used in all three workshops, students only commented on the music used in ‘Step into my world’ and ‘Localisation and EDD’. With comments relating to the emotional nature of the music used being made in relation to the ‘Step into my World’ (LS1M) and ‘Localisation and Emotionally Durable Design (T2L1T).

Students also discussed the nature of the lyrics in relation to the song used in the ‘Step into my World’ introduction, which had the same title and described stepping into another person’s world. Noting empathic (LS1M/3M & T1S1T), ethnographic (LS3M & T1S2T/5T) and user centred research (T1S5T) as a result and specifically relating to these in student group projects conducted at LSBU.

8.3.2. Visual nature

The use of images and the visual nature of the audio visual introductions were noted amongst students in the questionnaires and the workshop sessions additionally students at NTU noted the video nature of the presentations citing how this helped them think and remember aspects more easily (NTU1/2QS).

Some students commented on specific images used in the presentations with students describing individuals portrayed in the ‘Step into my World’ A/V introduction (LS1T/3T/4T/1M/6M) (T1S1T/3T).

“Portraits of people – view into their life (insight)” (LS1M)

A number of observations relating to objects from the Localisation and EDD A/V introduction were also noted relating to specific images and examples, which in the majority of cases led to further discussion (LL1T/2T/4T) (T2L2T/3T/4T/6T/1M)(CL2T).

“Pallet I think it is a great idea, what could possibly be bad about it. You are employing the local people you are giving them the means to make profit. I would say its sustainable, yes it is sustainable.” (CL3T)

Students also began to relate the examples given in the A/V introduction personally; contextualising aspects such as emotionally durable design, personal meaning and reuse by citing objects that they have an affinity with (LL3T/4T)(T1L1T)(T2L2T/3T).

“When I saw the bit about the sentimental design so the guy with his first car it kind of reminded me of a project that I am working on at the moment restoring a 1962 Vespa which is almost finished now. It’s kind of a piece of design that you relate to in a personal way.” (T2L2T)

Similarly the images of the Chinese factory workers and child labour in the ‘Exploitation’ A/V introduction appeared to be particularly memorable and were cited by several students (NE1T/2T/3T/1M/4M).

Whilst it was typically photographs from the A/V introductions that were cited, a number of students at each institution also recalled text based quotes from the materials, like the one noted above. Numerous references were made to the quote *“One man’s waste is another man’s treasure”* in the Localisation and EDD A/V introduction (LL13M) (T2L6T/4M/6M/7M/19M).

Students also recalled the figures quoted in regard to the hours worked and wages paid to the factory workers (NE3T/6M)(CE1T/6M).

8.3.3. Effectiveness of the workshop style and format

Students cited the A/V introductions as effective and informative (T2Q), describing how the format helped them to think (T2Q) and noting the emotive nature of the music (T2L1T)(LS1M)(NE1T/2T). One student noted how the format of the A/V introduction for 'Localisation and EDD' helped them to memorise the content more easily (T2Q).

"Video in 2nd activity & learning from, interesting could let me memorise things more easily". (T2Q)

Whilst the most emotional reactions were typically made in reference to the 'Exploitation' and 'Step into my World' A/V introductions, a BA student at NTU also found the content of the 'Localisation and EDD' A/V introduction emotional:

"You look a bit affected by that yeah, it was an emotional video, it was yeah I was a bit upset." (T2L4T)

This suggested that the student had deeply contextualised the sentimental aspects of EDD, which had brought up personal connections and memories. The 'Exploitation' A/V introduction generated the largest discussion and the most divisive debate amongst the students, considering issues such as; the responsibilities of designers (NE1T/2T)(CE1T) and opposing views on the use or need for child labour (NE2T), as well as the merits of methods for addressing the issues portrayed such as and transparency through traceability within the supply chain (NE1T)(CE1T).

The creative and applicable nature of 'Localisation and Emotionally Durable Design' particularly appealed to students due to the inclusion of existing examples, which they found inspirational (T2Q). The students actively engaged with the group work and group discussion aspect of the workshops, with evidence of group discussion evident across all 4 supporting university studies (LL1T/2T)(NE1T/2T/3T)

(TS2T/3T/5T)(T2L2T/4T)(CL1T/3T) particularly in the ‘Exploitation’ workshop at UWIC, which featured a number of lengthy discussions amongst the MSc students (CE1T).

“Perhaps you can have a little trail that you could follow on the internet or whatever. Yeah. So like made by such and such and packaged by such and such and then flown by such and such to here and almost, so it’s scanned at every point somehow. …. Yeah it’s like an audit trail …….. But then you maybe get a problem with sustainability and the green(wash) stuff that is going on right now that they can just there is no law of producing your own label you can produce your own label. If they made a standard for it and then it is almost like a way of making the company or companies accountable.” (CE1T)

Students also reflected the conflicting views that arose within the group discussion especially in relation to the workshop on exploitation. Students recognised that there were two viewpoints or arguments to a particular issue, grasping an important characteristic of the complexity of sustainability and demonstrating critical reflection.

“The other question is well you can say China and India are going through their Industrial Revolution, which we went through our industrial revolution where we had child labour, child chimney sweeps and you go through that so it’s almost like a rite of passage to go through and then. But how long has that lasted though, we had ours was. We endorse it yeah, but it doesn’t make it right does it. Yeah because when we had it other people weren’t paying them, we were paying them.” (NE2T)

8.3.4. Ability of workshops to introduce a range of social aspects of SPD

Students identified a number of social criteria from each on the workshops related to age, cultural diversity, employment equality, ethics, exploitation, inclusivity, need, poverty, responsibility and wellbeing. Within the ‘Step into

my World' workshop students reflected upon what linked such social issues drawing parallels between different groups (LS4T/6M). Whilst recognising the need for inclusive design, students also noted the differences and barriers due to culture, age, ability and language (LS4T/1M/2M/6M).

Students also linked the content of the 'Step into my World' A/V introduction to design deriving the need to design for all (LS1/3/6M)(T1S2T/1M/3M/8M), design for the underprivileged, minorities, other 90% (T1S4T/5T/3M) and to design for need (LS3M) (T1S4/5T)(T11/3/5/9M). Students also discussed potential design issues (T1S2T) such as accessibility of existing products (T1S2/4T) through group discussion.

Within this consideration of the different social needs of others students described how they felt unable to understand or comprehend the individuals as presented in the A/V introduction situation because they either had no experience of it (T1S5T) or because it was so different to their own situation (T1S1T/6M). This observation from the students of the need to be aware of other's needs, led students to discuss user research methods that could be used with the individuals portrayed in the A/V introductions and their particular needs and cultures (LS3/6M)(T1S2/5T). Students noted how empathic design methodologies (T1S1T/4M/5M) such as stakeholder design (T1S5/9M/5T), co-design (T1S9M) and ethnographic research (LS3M)(T1S2/5T/5M) could be used in conjunction with the different groups presented.

Responding to the 'Localisation and EDD' & 'Exploitation' workshops, students recognised the complexity of social sustainability when discussing locally produced goods as an alternative to the global economy, recognising that this would negatively affect workers in developing countries that depend on the global trade for employment (LL1T). Students concluded that design could in fact be used to address problems in traditional ways addressing needs as well as non-traditional ways such as raising awareness (NE1T) and redesigning systems (CE1T).

In the ‘Exploitation’ workshop students from NU and UWIC suggested various means of tracing the origin and history of a product to encourage accountability and transparency applying design thinking and systems thinking to the problem (NE1T)(CE1T).

“*If they made a standard for it and then it is almost like a way of making the company or companies accountable then. Bringing them to account say you’ve got this 10 year old here making all these iPhones and then you are shipping them here and then back round here and then they are in a lorry here do you not just. I don’t know it makes everything more transparent, a system a service product, service, system*.” (CE1T)

8.3.5. Lecturers’ views on the impact of the workshops

Discussing the impact that the workshops had upon students, all lecturers interviewed agreed that the workshops benefited students’ understanding of sustainability with both lecturers at LSBU noting how students had already applied learning from the workshops in their project work. A lecturer described how a number of students had picked up upon the need to design for the disabled from the ‘Step into my world’ workshop held at LSBU and had undertaken successful projects, exploring this need.

“The first project when we were talking about inclusivity and so forth definitely had an impact and an influence definitely, definitely you know they it certainly made them aware… Yep I do and I think it was quite amazing how with the first project when the students did the presentations how many actually were very consciously included things like wheelchair use.”

All lecturers agreed that the workshops had successfully introduced students to multiple aspects of sustainability. However the lecturers at LSBU had conflicting views on the impact of the second ‘Localisation and EDD’ workshop. One suggested that students were less successful in carrying through their learning than in the ‘Step into my World’ workshop but noted

that this may have been due to having the Christmas break in the middle of the module.

“Although with the second one at first they were talking about sort of social concerns and inequality and so forth but then they seem to forget a bit of those sorts of that information, those values when they actually came to do the design work but that might have been because of the Christmas holidays.”

Whilst the second lecturer considered the second workshop to be the most effective due to the examples featured in the A/V introduction which gave greater context.

8.4. Evidence of deep learning within the social aspects of SPD amongst individual students

The literature review demonstrated a link between deep learning, collaboration and critical reflection therefore the following section will also consider how these attitudes featured in the analysis of the student workshop experience.

8.4.1. Evidence of reflection, discussion and students own perspectives and insights.

Examples of reflection in the individual questionnaires were limited in their scope but student responses benefited from the group interaction and discussion in the workshops where design thinking approaches were discussed and the students grew in confidence recognising that design thinking could be used to address the issues identified in new and creative ways.

Therefore the group based discussion was key enabling students to reflect and explore the A/V introductions at a deeper level. Findings showed that the students engaged with aspects at a personal level as well as engaging in critical reflection in their group. Students discussed complex themes such

as designer's responsibilities, the complexity of child labour in developing nations and approaches which foster design thinking principles. Areas introduced above including group work, reflection and design thinking will be explored in greater detail in the following sections.

8.4.1.1. Group work

Evidence of group discussion was demonstrated with the workshop dialogue in all four of the supporting university studies (LL1/2T)(NE1/2/3T)(T1S2T)(T2L2/3/4/7T)(CE1T). Students reflected on the conflicting views that arose within the group discussion especially in relation to the workshop on exploitation (NE1/2T) (CE1T). These students recognised that there were often two viewpoints or arguments to a particular issue, for example when considering the exploitative labour in developing countries through the 'exploitation' workshop, students recognised that whilst inequality of low wages, long working hours and child labour was wrong, it still provided the workers with employment (CE1T)(NE2/3T). Similarly, when considering the detrimental environmental and social impacts of globalisation and the more sustainable opportunities offered by localisation, the students recognised that localisation would have a negative effect for workers in countries such as China, that rely on the current global model for employment (LL1T). Such examples demonstrate how the students grasped important characteristics of the complexity of sustainability through critical reflection.

8.4.1.2. Reflection

A number of the students reflected upon what they saw, personalising aspects of sustainability by contextualising what they saw in terms of their own lifestyle. An example of this was found within the 'Localisation and EDD' workshop, with students relating to the personalisation (LL3T) and EDD aspects in relation to products that they had an affinity with, such as heirlooms, items they had owned for prolonged periods of time or had invested time into(LL3/4T)(T2L3/5T)(T1L1T). An example was a student who was restoring a Vespa (T2L2) as well as how EDD could be applied to their on-going project work (T2L6T). Students also noted how they would

feel an affinity to something they have made relating to the pallet chair example (LL4T)(T2L7T)(T1L2T).

Students began to reflect upon and unravel the issues that underlined some of the issues explored within the workshops, beginning to question macro themes such as globalisation and mass production (T2L4/7T/1M & T1L1T) (NE1/2/3T)(CE1T/3M).
Students also reflected on more specific issues such as the effect of technology growth upon communities such as the elderly (T1S2T/8/10M):

In response to the 'Step into my World' A/V introduction students recognised social issues related to a lack of community, with students noting how the image of a teenager in front of a boarded up house reflected a lack of family cohesion and broken homes (LS4T), whilst some students noted loneliness as an issue related to the images of the elderly individuals (LS1/4T/2/5M).

However students also identified positive attitudes of individuals in the introduction, also noting how the disabled individual and young man from a developing country demonstrated or made them feel an appreciation for life (LS1/3T/5M). Students also noted the difficulties caused by languages and suggested the need for a universal language (LS1T/1M).

Students also endeavoured to relate the workshop content to design, considering how design approaches could address the issues raised. In particular, they discussed design for need (LS3M)(T1S2/4/5T/3/8/9M) (T2L7T) and how design for all isn't always possible, leading to a discussion on designing for groups of people (T1S2T) and identifying cultural differences relating to age, ability or ethnic origin (T1S1/3M). Students also differentiated between the need to design for 'true needs' (T1S2/4/5T) or 'needs and not wants' (LS2/3M), whilst students at NTU noted that minority groups are often overlooked in design being offered products that only meet their basic needs and they can't live as comfortably as a result (T1S5M) (T2L2T)(T2E11M). Students at UWIC remarked on the conflict portrayed in

the ‘Exploitation’ introduction that the workers couldn’t afford their basic needs despite making luxury goods for the developed world (CE1T).

“I want to add something about that, just that they are working in these conditions they even can’t provide themselves the basic necessities and they are just making luxury goods for us and they even can’t pay themselves the basic. The conflict they’re making the most luxurious stuff in the world but they can’t afford the basicness the necessities.” (CE1T)

The students also considered whether design was responsible for the issues portrayed and what the responsibilities were or should be upon designers (NE1/2/3T/10M)(CE1M) and whether they can be expected to be responsible for the effects of their products past the design stage, particularly in manufacture and at the end of life (NE7/9/10M)(CE1T/1M).

Expanding on the issues of responsibility students highlighted the need for and described potential approaches to address consumer awareness (NE1/2T/2/5/7M)(CL3T) (CE1T/2/4M) and societal attitudes and values that are wasteful and harmful to the environment and society (NUWE3T)(T1E1T) (T2L3/4T)(CE2/5M & CL1T). Students also recognised the importance of the social implications of localisation concerning job creation and reflecting on the importance of maintaining cultural identity (T2L7T/16M).

“But they were like making chairs to like give them money, yeah like the people. That makes sense and cos they can sell it can’t they. Makes shipping pointless. So it provides opportunities. If they all started working for us they might lose their sense of cultural identity.” (T2L7T)

Considering the prevalence of waste students noted social implications such as increasing awareness, with NTU students relating it to examples of recycling and reuse that they are aware of for example the Remarkable pencil cases and suggested that consumers need to considering the need of a product at purchase in relation to their wellbeing (T2L3/4T).

"You should think about it when you're buying it. You should think to yourself oh what effect, is this product going to have on my life." (T2L3T)

8.4.1.3. Design Thinking

Design thinking occurred in all three workshops (CL3T)(T2L25M)(T1S3M) but was particularly prominent in the workshop on exploitation (CE1T/5M) (NE1T/7M). Students questioned how they could address the issues portrayed, suggesting solutions which raised consumer awareness including labelling on products that would enable consumers to trace the product.

"I've had quite a good idea you know when you buy like a fridge; it has like the energy efficiency, like colour coded. You should have an ethical efficiency something like that.... A world the greener it is the more ethical it is, because if it's red you wouldn't buy it. Do a key of ethical do that try it, a key or an approval standard on stuff like buy fair-trade." (NE1T)

Students also discussed corporate transparency, which would require manufacturing outsourcing in the developing world to become a public procedure promoting transparency and good practise (CE5M).

In addition to students adopting design thinking skills, students also began to consider and discuss the need for a redesign at a systems level to address the issues (CE1T).

"Change the system you know what I meant we need some regulation for import and exports, because you can change your design for more sustainable stuff but people in China still dying and working like very hard." (CE1T)

8.5. Ability to address multiple aspects of social sustainability

Each of the workshops portrayed multiple social sustainability criteria derived from the literature and academic interviews and developed in

section 6.2. These social sustainability aspects were reflected in the student's response to the workshops, with references being noted to numerous different criteria within each workshop.

From the 'Step into my World' workshop students considered:

- Affordability.
- Inclusive design and design for all specifically noting the elderly and disabled.
- Design for need, design for the other 90% and the underprivileged.
- Community issues including isolation, the breakdown of family and deprivation.
- Cultural diversity, including different ethnicities, faiths and languages.
- Importance of wellbeing and quality of life.
- Empathic design research strategies such as ethnography and user centred design.

From the 'Exploitation' workshop students considered:

- Addressing the needs of the underprivileged.
- Exploitation including child labour and poor working conditions and hours.
- Inequality including poor pay in respect to living costs and OEM's profit margins.
- Designers' responsibilities and the ethics of design.
- Design thinking strategies raising consumer awareness of unethical practices, enabling transparency through a product tracking system and engaging with the agencies involved to bring about change.
- Design for social wellbeing and affordability.

From the 'Localisation and EDD' workshop students considered:

- Affordability
- Emotionally durable design and its attributes including attachment, personal meaning and personalisation
- Localisation, including the benefits to the environment and society as well as potential drawbacks
- Design thinking strategies such as enabling traceability through labelling to promote localisation

- Reuse including the cultural implications and the link to affordability
- Social wellbeing through community and sustainable living

Students also began to look for connections between the content. This was particularly evident in the ‘Step into my World’ workshop, where students sought to make links between the individuals portrayed (LS4T). Students also began to demonstrate an understanding of how the social and environmental aspects interrelated and could even conflict with each other, especially in the ‘Localisation and EDD’ workshop where students noted the positive effects of localisation on both the environment and employment, whilst recognising that moving away from globalised production would negatively affect workers in China who would lose jobs (LL1T/12M).

Students also recognised the link between poverty and living a sustainable lifestyle through the reuse examples given in the ‘Localisation and EDD’ workshop (T2L2T/21/22M).

“It’s good in what way does that, reuse of waste. I like that one; they are quite big on it there (developing country). Yeah they have to be resourceful. Need for resourcefulness.” (T2L2T)

UWIC students carried across learning and content between the workshops discussing localisation within the ‘Exploitation’ workshop, which was conducted the day after the ‘Localisation and EDD’ workshop.

There were also instances where students cited how examples used in the presentation met the three pillars of sustainability, further demonstrating their grasp of the complex nature of sustainability through the trials (T1S5T) (T2L1/4T/1M)(CL3T).

“I liked the fact that the crate benefitted more than one person, benefits who? Benefits the environment, because it is ethical. The environment, user and producer, yep.” (T2L4T)

8.6. Evidence of applying learning from workshops

It was difficult to measure how the workshops impacted upon the students practice and understanding beyond the workshop activity, as the researcher only had access to the student outcomes from the modules in one of the supporting universities LSBU. However there was evidence of students relating the workshop content to projects that they were currently undertaking this was most obvious amongst the NTU BA students who were undertaking a redesign exercise at the time the workshop was conducted. Students considered how they could apply principles such as emotionally durable design (T2L4T/17/29M), personalisation (T2L4/6T/10/11M), reuse (T2L10m) and localisation (T2L10M) to the products they were redesigning, which included an electric juicer, blender, whisk and foot massager. These students also noted in the final questionnaire that the activities were useful to their project work (T2Q).

"I like the video. The activities help with designing the product for this project. Taking more into account with designing." (T2Q)

Where a full review of the student project outcomes was possible the researcher noted examples relating to the 'Step into my World' workshop conducted at LSBU and the lecturers also picked up on influences in the student outcomes relating to the workshop as noted in section 8.3.5.

The most interesting finding was derived from one particular group at LSBU who continued a theme of intergenerational design that they arrived at during the course of the 'Step into my World' workshop. This particular group unlike others named every piece of work and even named themselves in the audio recordings allowing the research to identify all their work to be pieced together and examined in relation to their final outcome.

In the workshop the group noted that the 5 pictures of people were actually 5 different stories relating to their individual lives and sought to link them (LS4T/5/6M). The group noted how the youth portrayed in the A/V

introduction could be a result of broken family and the loneliness of the elderly lady the group sought to produce a design that united different generations.

"Family the old lady doesn't have any and the guy with the hoody didn't look like he appreciated his family….. His angry because…….yeah that's true broken family….. There's five different stories in that presentation I mean….. maybe you can link them together" (LS4T)

The group eventually produced a design for a product that served the needs of three generations, encouraging interaction and communication between the generations in the form of multipurpose park seating attempting to address the importance of family.

Figure 21 Mindmaps produced by the group

As part of this process the student's interviewed three generations including grandchildren, parents and grandparents and chosen a product that is placed within a park, which is potentially linked to one of the concerns that they had during the workshop was that the elderly lady pictured was stuck indoors.

There were clearly references in their project outcome to their learning and reflections during the 'Step into my World' workshop, developing aspects of deep learning from the students initial workshop reflections concerning broken families, social deprivation and loneliness in elderly people.

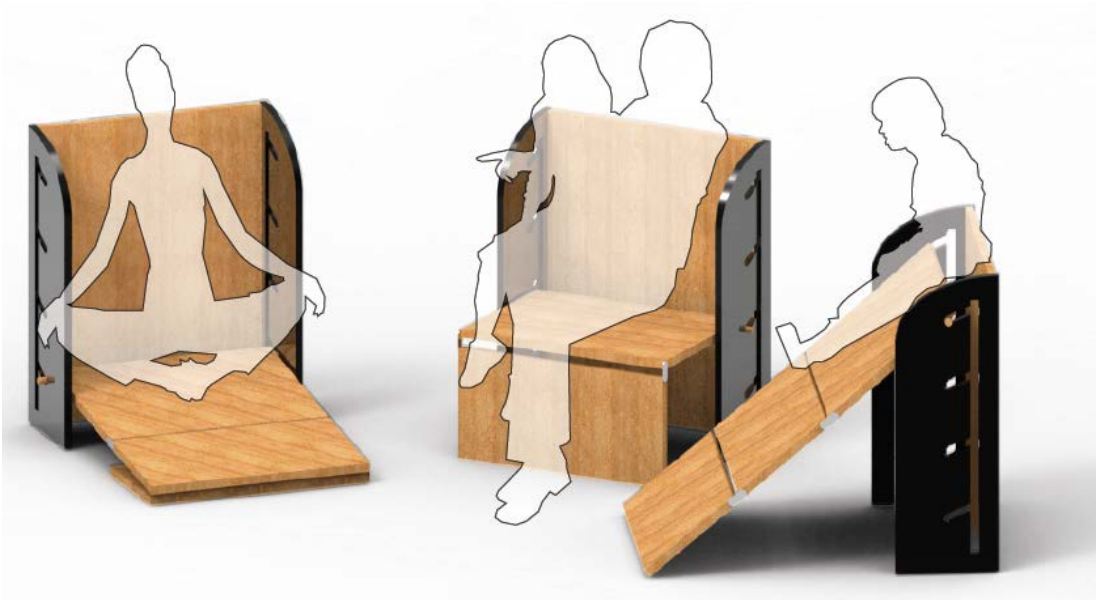


Figure 22: Design concept for intergenerational public seating

8.7. Conclusions

The A/V nature of the workshop introductions proved to be effective both in engaging the students as well as being memorable, as demonstrated by students reciting exact quotes and accurately describing detail in images. Moreover the audio in one workshop (in particular 'Step into my World') led students to a deeper exploration of the content to explore empathic design research approaches. More importantly the A/V introductions were engaging enough to foster group discussion and debate amongst the students. It was this discussion and debate in the workshops that was found to have instigated critical reflection and deep learning that was initially absent in the students' individual responses.

The approaches used in these workshops enabled students to explore multiple social sustainability aspects within a short space of time. The workshops were successful in addressing a range of social sustainability criteria and encouraging students to consider such issues in respect to their discipline. Whilst the workshops addressed a number of social sustainability issues, it was the students who reflected upon how these related to their practice considering issues such as a designer's responsibilities. This was prompted by the workshop questions, whilst other findings such as the

design thinking solutions were derived and driven entirely by the students in response to identifying needs from the A/V introductions.

The impact of the workshops upon student's attitudes however was difficult to measure from just the questionnaire responses and diaries like those conducted at UL would have also greatly benefitted the supporting studies at LSBU, NU, NTU and UWIC. Likewise the impact on the students practice beyond the workshops was difficult to measure except in the case of the group of students from LSBU, this was in part due to the limited access to the students and would only be addressed in a setting where the researcher was also the tutor.

Chapter 9. Discussion

This chapter will initially discuss how the research questions of the study have been addressed through the following sections:

- Exploring the pre-existing limitations or barriers to teaching the social aspects of SPD.
- Incorporating sustainability into the students' learning experience.
- Introducing social aspects of SPD into the students' learning experience.
- The most appropriate methods for enabling students to engage with social aspects of sustainability, leading to an improvement in understanding.
- Fostering deep learning in respect to the social aspects of SPD.
- The breadth of the research study

The chapter will initially address how the findings derived from the academic interviews answered the first three research questions, before discussing the design and development of the 'Rethinking Design' workshops and the findings from the 'Rethinking Design' workshops. The chapter will then end by discussing additional aspects of the study including the repeatability and breadth of the main study for informing SPD education in Universities in the UK and Ireland.

9.1. Exploring the pre-existing limitations or barriers in teaching the social aspects of SPD

The following section discusses the limitations of and barriers to teaching the social aspects of SPD as identified through the academic interviews detailed previously in Chapter 5 and how these limitations were addressed through the 'Rethinking Design' workshops.

Academics highlighted that the social aspects of SPD are more complex than the environmental considerations agreeing with the literature concerning the tangible and intangible aspects of SPD as noted by Cull

(2005). These findings also highlighted that the social aspects of SPD cannot be taught in the same way as the environmental aspects, requiring different teaching and learning techniques to be employed. Additionally it was also noted that the breadth of social considerations within SPD, are too wide to address within a 3 year undergraduate program using the same methods as ecodesign considerations. Therefore the 'Rethinking Design series' workshops were designed and developed in such a way to introduce students to a range of social aspects of SPD in each individual A/V introduction. The findings have confirmed that each of the workshops successfully addressed numerous social aspects of SPD. The researcher suggests that the key difference, which enabled the workshops to consider multiple criteria, was the fostering of a learner centred exploratory approach as recognised in the literature (Warburton, 2003, Wals and Jickling, 2002) where students learn through discovery and reflection.

It was also noted in the findings in section 5.2.3 that the social aspects of SPD are difficult to teach in large groups, which restrict the ability for students to engage in discussion. Therefore small groups of only 4 - 5 individuals were used in the 'Rethinking Design' workshops. The use of small groups to address sustainability in itself isn't novel, but integrating this into the workshop design was key, to encouraging discussion and debate amongst the students.

Academics also recognised a tendency amongst students to compartmentalise their sustainability learning, which agree with the literature (Ramirez, 2007b). These instances cited by academics referred to examples where the students were taught sustainability within a specific module, drawing similarities with Ramirez's (2007b) findings, that compartmentalising of sustainability occurred when sustainability was taught theoretically or methodologically rather than contextually. Academics who taught sustainability more discretely throughout the curriculum often taught sustainability contextually through project work or studio teaching and didn't recognise such issues. This agrees with both Park (2010) and Gürel (2010)

who suggest that sustainability is best taught discretely through the existing design curriculum, as well as the conclusions from the nationwide survey in Chapter 4, where academics unanimously agreed that sustainability should be integrated throughout the curriculum. However a key criticism that could be made of a contextual approach to sustainability could be that students would conform to an applied rather than holistic approach to addressing sustainability. Rather, the focus of the 'Rethinking Design' workshops, as the title suggests, was to encourage and enable students to think holistically and resulted in students adopting a systems thinking approach by developing design thinking skills.

Each of these considerations will be discussed in more detail in the following sections.

9.2. Incorporating sustainability into the students' learning experience

Due to the way academics responded to the interview questions this section relates to sustainability teaching and learning in general and isn't specific only to social sustainability unless stated as such in the text. Discussing the learning environments in which SPD is taught, over half the academics cited the studio as the environment where they felt it was most appropriate to introduce sustainability. These academics additionally suggested that sustainability is best addressed contextually as required through students' projects, which is in agreement with the most popular form of delivery in the nationwide survey findings in section 4.2.1.3. as well as the literature (Park, 2010, Gürel, 2010).

Academics noted that introducing aspects of sustainability as required through studio teaching ensures that it is perceived as relevant and relevance was noted as a key attribute in fostering deep learning in the literature (Warburton, 2003). Additionally a lecturer noted that the social aspects of SPD are more suited to this form of teaching benefiting from teaching or discussion within the context of a student's project in a studio or

tutorial environment. However whilst there are clear benefits cited of studio teaching, definitions of what constitutes studios seems to differ between the universities involved in this study. To the researcher and two of the universities involved in the main study, studios are permanent facilities that are open to the students at all times often with a designated working space, whilst other universities describe studio teaching as applicable to project based teaching and tutorials.

Therefore replicating a studio environment at each of the institutions involved was not possible, nor was it possible to ensure that the ‘Rethinking Design series’ workshops fitted contextually within the project work at each institution as two universities were not offering a project based module. However the group based aspect of the workshop fostered discussion and therefore mimicked a tutorial setting, as recommended.

Of the 10 workshops that were conducted, 6 were conducted within a project outcome module and 4 were conducted within a design contexts module. However the lecturer at UL where the workshops were conducted in a design contexts module noted how a student utilised learning from the workshops in another project based module. This is despite the findings of Ramirez (2007b) and academics in earlier research who noted a tendency to compartmentalise learning when taught theoretically, suggesting that the ‘Rethinking Design series’ workshop format overcame this tendency to compartmentalise learning. This could be attributed to the contextual nature of the workshop in question, ‘Localisation and Emotionally Durable Design’, which featured numerous examples of the prompts throughout the workshop for students to reflect the content to their practice.
Informal peer assessment methods including peer discussion of presentations and critique of design projects where cited by the majority of academics in respect to teaching SPD. Group work and teamwork were also widely cited for encouraging peer discussion in respect to sustainability, agreeing with both the education for sustainability literature (Henry-Stone, 2010, Cortese, 2003, Wals and Jickling, 2002, Kelly, 2010, Warburton,

2003) and preferences of the net generation literature (Oblinger and Oblinger, 2005b, Tapscott, 2009, Barnes et al., 2007, Howe and Strauss, 2003).

Other methods noted by academics included the use of questioning techniques, which agrees with the descriptions in literature of how net generation students prefer to learn by discovery (Oblinger and Oblinger, 2005b, Tapscott, 2009). Peer learning was noted by a student as a key aspect of his learning in the 'Rethinking Design' workshops, agreeing with the literature (Oblinger and Oblinger, 2005b), which suggests that 'Net generation' students prefer to learn from peer to peer interaction. Open ended questioning was used in the 'Rethinking Design' workshops to encourage students to reflect on and discuss what they had seen in the A/V introductions. This use of open-ended questioning was successful in engaging students in discussion and debate; methods also cited in the academic interviews for offering students the opportunity to engage in peer learning.

The open-ended questions posed in the 'Rethinking design series' workshops also helped to give the workshops structure and initially prompted students to engage with the A/V introductions. Amongst the younger 1st year undergraduate students these questions were seen as tasks and the students worked through them methodically, reading them, discussing them, recording the group's response and moving on to the next, whilst the postgraduate students used them as a starting point to more in-depth discussions, more concerned with discussing the details and sharing experiences and cultural perspectives than recording their thoughts.

Comparing the response between the levels of students further, it was found that whilst all the levels of students engaged with the content of the workshops the postgraduate students engaged in the workshops at a much deeper level than the undergraduate students and even between the 2nd year and 1st year students there was a noticeable difference in the level of

engagement in discussion. The time given to each workshop was typically 35-40 minutes for the 1st year students, 45 – 50 minutes for the 2nd year students and up to 2 hours for the postgraduate MSc students. The session that lasted this long was the 'Exploitation' workshop, which was discussed in depth amongst four students from different countries, Belgium, Egypt, France and the UK with each bringing to bear examples and experiences from their own cultures and a particular passion amongst the Egyptian student for change, in the light of the recent political changes in the Arab Spring at the time.

Discussing the use of lifecycle consideration and material selection tools, it was noted by an academic that whilst they may be applicable to the environmental aspects of SPD they weren't suitable for the more holistic social aspects. However a number of academics described their preference for the IDEO method cards due to their visual nature, in agreement with the literature (Oblinger and Oblinger, 2005b, Windham, 2005, Tapscott, 2009, Holliday and Li, 2004), which cite the visual preference of net generation students, as well as the A/V literature which note the benefit of visual approaches (Hanson, 2002; Perkins, 1994; Schell et al., 2009).

The 'Rethinking Design Series' workshops incorporated this visual preference through the image rich A/V introductions and built upon the IDEO method card format, which sought to facilitate questioning amongst designers in user centred design approaches (IDEO, 2002). However the 'Rethinking Design Series' workshops went further adding music for a multimodal learning experience and fostered reflection, personalisation and critical discussion, thus enabling key components of sustainability to be explored.

Academics also cited opportunities for students to participate in experiential and immersive forms of learning as beneficial to an understanding of sustainability, as recognised in the literature on SPD (Wilgeroth et al., 2008, Gürel, 2010). Academics suggested methods such as field trips related to

study, volunteering in the community and working with external clients. Experiential methods were unfortunately out of the scope of the research study. However it could be argued that the 'Rethinking Design Series' workshops managed to create an immersive learning context due to the creation of indirect experiences through the use of images as suggested by Murray (2011) in the literature. This immersive experience was demonstrated by the students' ability to reflect personally on the content of the A/V introductions. In addition, all 3 workshops were conducted intensively on the same day at UL, helping to foster an immersive learning experience at this institution. This immersive experience wasn't possible at the other universities although two workshops were conducted on consecutive evening and morning sessions at UWIC.

9.2.1. Relevant merits of intensive workshop approach

The intensive nature offered at UL meant that the students had freshly explored previous workshops as they begun the 2nd and 3rd workshop which enabled them to carry social aspects and learning through to the subsequent and this was recognised within the findings. However conducting all three workshops on the same day may have overwhelmed students and reduced their ability to reflect on each individual workshop and this could be supported by the fact that students generally discussed the 'Rethinking Design' workshops as a whole in their diaries as they saw the three workshops as one extended exercise rather than three separate learning opportunities, perhaps because they were conducted on the same day.

However the researcher also recognises that conducting the workshops two months apart at LSBU was less beneficial especially in terms of data collection as students had forgotten aspects of the 1st workshop by the time the 2nd questionnaire was conducted. Ideally the workshops would perhaps be run across three consecutive days mimicking the model used at UWIC timetable permitting or across 3 weeks, an approach that has since been used in the researchers own teaching at the University of Hertfordshire

enabling students to reflect fully on the each individual workshop, but still maintain the continuity in the ‘Rethinking Design series’.

9.3. Introducing the Social aspects of SPD

The following two sections will discuss firstly the definition of the social SPD criteria and then how these were addressed and understood through the ‘Rethinking Design series’ workshops.

9.3.1. Identifying the social aspects of SPD

This section of the research study was conflicted, especially within the nationwide survey, as a number of aspects relating to social equity within design cross into existing specialisms within the product design curriculum such as inclusive design, which at its root is concerned with equity in design for all regardless of age, abilities or culture within design. This crossover between the socially equitable aspects of SPD and socially orientated specialisms within product design is to be expected and in the context of an integrated curriculum positively embraced, as recognising such links is likely to help address the tendency of students to compartmentalise their learning in sustainability (Ramirez, 2007b).

However, such overlap between disciplines can cause confusion for students or add to the misunderstanding of the umbrella term of SPD. Additionally it could cause resentment between academic staff in the related specialist fields who may view the integration of SPD as a threat to their own curriculum area. Considering these complications and misunderstandings of the definition of SPD it is unsurprising that a number of the academics interviewed noted that they prefer not to use the term sustainability, instead replacing it with their own terminology or simply referring to sustainability as just an aspect of ‘Good Design’. It was recognition of these positions and the relating confusion that caused the workshops to be titled ‘Rethinking Design’, which the researcher felt portrayed the holistic and systems orientated nature of sustainability and provided problem solving opportunities that were also consistent with Design Thinking.

However the researcher also recognises that it is still important to use and more importantly understand the term sustainability, as students will eventually enter workplaces where the term is used. Therefore it is important to ensure that students understand that sustainability is a complex balance of economic, environmental and social issues, because focussing on only one aspect of sustainability, as the students discovered through the workshops, can have a detrimental effect upon another aspect.

Other considerations, such as ‘Affordable design’ can be included in SPD as a social consideration because it fosters social equity. However it could be argued that such a term is in conflict with the environmental aspects of sustainability, as affordable design within a developed world context could be associated with cheap disposable products, which perpetuate the throwaway society model. However the term ‘Affordable design’ was deemed relevant within the ‘Rethinking Design series’ workshop ‘Localisation and Emotionally Durable Design’, where examples of reuse from the developing world were shown to demonstrate a lack of affordability, with students noting how design for reuse could effectively address both environmental and social requirements of SPD.

Despite the conflicts noted, the identification of the social SPD criteria in Table 12 taken from section 6.1 was important in defining the content of the ‘Rethinking Design’ workshops and demonstrating the social angle of SPD to students. Additionally it is anticipated that that these social SPD criteria are valid and useful beyond this PhD study, providing a framework that can be used by others to enhance student design project briefs and guide further research.

Design for the other 90%	Personal Meaning	Ethical design
Affordable Design	Culturally sensitive design	Affordable Design
Culturally sensitive design	Emotionally Durable Design	Corporate Social Responsibility
Design for Communities	Localisation	Culturally sensitive design
Design against Crime	Participatory Design	Social Equity
Design for the needs of the developing world	Wellbeing	Social Justice
Design for True Need		Responsible Design
Inclusive Design		
Participatory Design		

Table 13 Framework of Social SPD themes for the Rethinking Design Series

9.3.2. Addressing multiple aspects of Social SPD

Within the research question: 'Identifying the social aspects of SPD' there was also a desire to address multiple aspects of social SPD in each of the workshops. This was driven by a desire to portray the interconnectedness and interrelatedness of sustainability as well as enabling a wider breadth of social SPD to be addressed without challenging the crowded nature of the Product Design curriculum as highlighted in the academic interviews.

Identification of social sustainability aspects were reflected in all four stages of the students' response to the workshops as referred to in section 7.5, with references being noted in respect to numerous different criteria within each workshop.

Whilst it could be argued that the acknowledgement of some of the social issues could have been expected due to the images used in the A/V introductions, it was how the students reflected upon what linked these social aspects together that demonstrated a grasp of the interrelatedness of social sustainability, with students looking for connections between the content. This was particularly evident in the 'Step into my World' workshop, where students sought to make links between the individuals portrayed,

recognising that the individuals were all connected by the fact that they were marginalised in society and had specific needs. Developing this a number of students sought to consider products of services that could serve the needs of more than one of the individuals and this was especially the case amongst the group at LSBU that developed the intergenerational seating noted in section 8.6. This searching for connections between the individuals echoes the interconnected and interrelated (Wals and Jickling, 2002) nature of sustainability.

Furthermore, students began to demonstrate an understanding of how the social and environmental aspects interrelated and could even conflict with each other, especially in the ‘Localisation and EDD’ workshop where students noted the positive effects of localisation on both the environment and employment, whilst recognising that moving away from globalised production would negatively affect workers in China who would lose jobs. Students also recognised the link between poverty and living a sustainable lifestyle, noting how poverty leads to resourcefulness in relation to examples of reuse in the ‘Localisation and EDD’ workshop.

Students also began to relate the individual ‘Rethinking Design Series’ workshops to each other, carrying across learning or content from one workshop into another. This was particularly the case at UL where all three workshops were conducted on the same day, with evidence of students building upon their prior learning. Examples of this included bringing aspects such as labelling for product traceability and mass production ethics and equity over from the ‘Exploitation’ workshop into the ‘Localisation and EDD’ workshop. Alternatively, when the workshops were conducted the other way round at UWIC students discussed localisation from the previous ‘Localisation and EDD’ workshop within the ‘Exploitation’ workshop, the subsequent day. The lecturer from UL also noted this bringing together of the different aspects suggesting that the lecturer had also recognised the links students had made in both the individual workshops and across the different workshops. However this could be critically explained away by the

fact that students recognised the design and style of the workshop and saw it as a related activity.

However, despite the workshops not specifically mentioning sustainability as a term in the presented or feedback materials, there were examples of students describing how examples portrayed met the three pillars of sustainability as noted in section 8.5, suggesting that not only did they interrelate the content but that they related the social aspects of sustainability portrayed within the workshops to the wider triple bottom line (Elkington, 1998).

Students concluded that design could be used to address problems in traditional ways addressing physical needs as well as through non-traditional methods by fostering design thinking in relation to public awareness campaigns and systems design. For example in the 'Exploitation' workshop students suggested various ways of tracing the origin and history of a product to encourage accountability and transparency by applying design thinking and systems thinking, a key attribute of sustainability in the literature (Warburton, 2003, McNerney and Davis, 1996, Li and Williams, 2006, Wals and Jickling, 2002, Cortese, 2003, Henry-Stone, 2010, Huckle and Sterling, 1997).

9.4. The most appropriate methods for enabling students to engage with social aspects of sustainability, leading to an improvement in understanding

Literature suggests that the audio visual group based approach taken with the workshop as described in section 6.2 should be beneficial to the students' learning in a numerous ways as outlined in the literature sections 2.1, 2.2, 2.3 & 2.6. Sections 9.4.2 to 9.4.6 will discuss how the audio-visual and group based approaches to the workshops were received by the students and how they affected their understanding in respect to the social aspects of sustainability.

9.4.1. Development of the ‘Rethinking Design series’ workshops

This section will consider the decisions made, difficulties addressed and limitations within the development of the ‘Rethinking Design series’ workshops.

Whilst the A/V introductions were the shortest element of the workshops they were the most important as they set the scene for student reflection and therefore learning. Selecting the content of each of the A/V introductions was a difficult task with the researcher considering how to effectively provide images and music that could elicit reflection along a particular theme of social sustainability.

9.4.1.1. Sourcing appropriate music

Music was sought that specifically suited the social aspects identified for inclusion in each workshop. This was a difficult task as each workshop featured required the inclusion of a number of different social aspects of SPD and therefore a piece of music had to be selected which complimented the images and ideally added to the message of each workshop as noted in section 6.2. Both pieces of music used in ‘Step into my World’ and ‘Exploitation’ workshops enabled this, however difficulty arose in the selection of music for the ‘Localisation and Emotionally Durable Design’ workshop as the researcher couldn’t find a piece of music containing lyrics that permitted the breadth of issues to be addressed. As discussed in section 6.2.1.2. The researcher wanted to keep the continuity however in the ‘Rethinking Design series’ workshops and recognised that the inclusion of music was important in adding to the relevance of the materials. Therefore an instrumental piece of music was chosen for the ‘Localisation and EDD’ workshop to give a sense of urgency in addressing the issues involved.

9.4.1.2. Selection of appropriate images

Images were selected to portray certain aspects pertinent to delivering the multiple aspects of social SPD as intended in each workshop. Images were

chosen carefully to elicit reflection in order to help create the indirect experience that Murray (2011) alludes to, as important in promoting the personalisation of sustainability.

Whilst the researcher as noted in section 6.2.1.1 was careful to choose images that didn't represent stereotypes to avoid bias the subjective nature of visual imagery meant that some individuals drew very different responses, dependant perhaps on their preconceptions or experiences. One lecturer who previewed the 'Step into my World' workshop took a dislike to the images suggesting that the elderly lady in figure 24 appeared unhappy and lonely and the wheelchair user in figure 23 looked like he had been abandoned. This suggested that this viewer's interpretation of the images was dependant on an external preconception that was outside of the researcher's influence. However, whilst a few students also noted that the elderly woman appeared lonely, none of the students involved shared the view that the wheelchair user had been abandoned but rather noted the outgoing nature as the researcher had intended.

Figure 23 Wheelchair user

Figure 24 Elderly lady portrayed in 'Step into my World'

Whilst the images used in the 'Step into my World workshop were subjective and could be left open to interpretation, a number of the images in the 'Exploitation' workshop required explanation to ensure that the students derived the correct meaning as they were evidence based and could otherwise cause confusion or incorrect interpretation. The 'Localisation and

EDD' workshop also used text, although this was infrequent and most examples featured shorter descriptions to act as pointers rather than explanations. An example of this was the shipping container with the distance travelled between Shanghai and London, shown in figure 25.

Figure 25 Shipping container image

9.4.2. Audio nature of introduction

Music was used in the A/V introductions to all three workshops, but was only noted by students in response to two of the workshops. Students described the emotional nature of the music used in relation to both 'Step into my World' and 'Localisation and EDD', this recognises Crowther's (2012) view that music can evoke strong emotions. However, surprisingly, the music used within the 'Exploitation' introduction, was not noted at any of the three universities where it was used, despite it being the most descriptive lyrically. Although the workshop was noted by students as the most emotionally charged.

There could be a number of reasons why the music in the 'Exploitation' workshop wasn't mentioned. For instance the piece of music used was more complex lyrically and less repetitive than the piece of music used in the 'Step into my World' workshop, so it may have been less memorable. There were however subtle differences between the three A/V introductions, with the 'Exploitation' introduction containing much more text to explain the background to the images and featuring more intense visual content. It is

suggested that this could have diverted the students' attention away from the music or alternatively the visual elements may have just been more memorable than the audio.

All the students who commented on the inclusion of music were positive, suggesting that the music improved the presentation, by providing additional meaning and understanding especially in respect to the 'Step into my World' workshop as noted in section 7.3.1 & 8.3.1, which described how the students elicited additional meaning from the addition of music. The positive reaction and recognition that the music added to the learning experience supports the literature (Ahlkvist, 2001; Albers & Bach, 2003; Martinez, 1995) as described in section 2.3.1. The lyrics of the song, which invited the listener to 'step into another's world' were effective in formulating discussion and thinking in agreement with literature (Ahlkvist, 2001; Albers & Bach, 2003; Martinez, 1995) and led to the consideration of user centred empathic research approaches including ethnography and co design. This suggests that the students had considered how they could step into the world of the individuals portrayed in the A/V introduction, personally reflecting on the needs represented in the workshop. Exposing students to cultures outside of their own as described in the literature (Albers & Bach, 2003; Brkich, 2012). Such observations were made by students at all of the universities where the 'Step into my World' workshop was conducted suggesting that the connection was made universally. This in turn suggests that the literature findings relating to the personalisation of sustainability through the creation of an indirect experience (Murray, 2011) could be extended further to include music as a key element amongst the 'net generation' learners.

9.4.3. Visual nature

The use of carefully selected photographs within the A/V introductions helped to foster the indirect experiences that Murray (2011) describes in the literature. The responses from the students suggested that the photographs used were particularly evocative and memorable, expressing emotion and stories that students could link to the individuals portrayed. The students described how the portraits of the people in the 'Step into my world'

introduction gave an insight into their lives, and students typically made generalisations from each of the photographs to describe the lifestyle or needs of the individual portrayed. Interpreting the image and deducing the meaning as described by Perkins (1994). This filling in of the gaps is also acknowledged by Murray, (2011) in relation to the use of imagery, but cited as a disadvantage as it leads to generalisations. However for the purposes of these workshops it was beneficial as the students began to derive needs and design solutions from their interpretations. Students also in part recognised that they were making generalisations and recognised the need for user centred research in relation to the message portrayed from the music as noted in sections 7.3.1 & 8.3.1.

The evocative nature of the photographs and the length of time that the each photograph was shown caused students to remember the image long after it was displayed. The was intentional to provide time for students to process the image as noted in the literature (Hanson, 2002; Perkins, 1994). The length that the photographs were shown was particularly noticeable in the ‘Step into my World’ workshop to the extent that it was almost disconcerting to the viewer. However this could have influenced the particularly memorable nature of each individual portrayed, as all groups readily discussed each individual portrayed in the workshop.

Individual photographs were instrumental in fostering discussion and in some cases critical debate as predicted by the literature (Hanson, 2002; Schell et al., 2009), with multiple interpretations arising amongst the students into the meaning. For example students were divided in their opinions of the low cost handmade artefacts featured in the ‘Localisation and EDD’ A/V introduction. Some suggested that such reuse was letting companies off the hook when they should be ensuring recycling occurs at the end of life, whilst other students recognised the affordability and cultural relevance of reuse.

Certain images led to much more in depth debate with students unravelling complex themes behind individual images, such as the simple ‘Made in China’ image with students interpreting what this meant on multiple levels, reflecting on the effects of mass manufacture in the Far East, including labour issues, cost and the environmental effects of shipping. The inclusion of labour issues in the discussion at NTU was particularly interesting as the BA students involved only participated in the ‘Localisation and EDD’ workshop. They had no prior exposure to the ‘Exploitation’ materials but had effectively uncovered far wider reaching issues through the discussion of a single image. This highlights the ability of students to draw multiple meanings through reflection upon a single image, whilst the complete A/V presentations were intended to explore multiple aspects of social sustainability it was interesting to note that this was also the case with specific photographs within the A/V introductions. The simple ‘Made in China’ image elicited reflection as did the pallet chair example, with students recognising all three pillars of sustainability, the economic, environmental and social aspects, through the group based discussion and reflection.

Despite the social SPD focus of the ‘Rethinking Design Series’ workshops some students explored and discussed aspects relating to the wider context of Product Design such as the aesthetic value of the reused examples or whether the reused examples were indeed examples of industrial design because they weren’t mass produced. This suggested that the workshops had encouraged them to consider the content in terms of their wider practice, helping them to integrate social sustainability rather than compartmentalise it (Ramirez, 2007b).

From the ‘Exploitation’ introduction students noted a range of images with many focussing on those which shocked them the most relating to the Chinese factory workers and child labour. However the greatest impact from this introduction appeared to be related to the supporting text included with the images, with students recalling the facts and figures quoted in relation to the hours worked and wages paid to the Chinese factory workers. This

suggests that whilst the highly visual nature of the images was effective throughout the workshops, the students also memorised the key facts and figures particularly well, which could indicate that the students preferred the exact information that these portrayed in respect to the subjective nature of photographs.

However, the length of these almost headline like text based quotes also appeared to have been a key factor in the ability to be memorable as the students didn't cite other information given in longer text based quotes in the 'Exploitation' and 'Localisation and EDD' A/V introductions. However it should be highlighted that whilst the short text based quotes were memorable they didn't elicit the same level of reflection amongst the students as the photographs. The student's response to the headline text quotes could suggest only a surface level interaction with the text as outlined in section 2.1.4 by recalling the facts, whilst the visual images elicited deep learning. Therefore the text based material was merely useful to convey understanding and give detail required for understanding the images.

The findings suggest that the visual imagery used within the A/V introductions was a highly effective way of portraying the content, and encouraged reflection amongst the learners. This echoes the literature findings in a number of ways. Agreeing with the A/V literature in section 3 (Hanson, 2002; Perkins, 1994; Schell et al., 2009), the 'Net Generation' learners' preference for visual methods (Holiday and Li 2004; Oblinger and Oblinger 2005; Windham 2005; Tapscott 2009) and the development of an indirect experience through the use of striking photographs (Murray 2011).

9.4.4. Skills required to develop the A/V Introductions

Developing these A/V introductions required skills that the researcher may take for granted due to his background in teaching and interest as an amateur photographer. The researcher's prior experience as a secondary school teacher brings an understanding of the culture of the 'Net Generation' and experience of their particular learning styles. The selection

of appropriate images, whilst time consuming was enhanced by the researchers understanding of photography enabling the researcher to select prominent, eye catching images that effectively portray a message and this was matched by an understanding of how the images could be displayed to resonate with particular pieces of music. However whilst these skills were important the repeatability of these approaches by lecturers in product design is still possible, though the understanding of the 'Net Generation' given in this study and through the use of resources such as Panos (Panos Pictures, 2012) a photo agency that specialises in social global images.

The design and development of such workshops also requires careful planning and objectivity to avoid bias and ensure that students are able to develop their own critical understanding of the issues involved. This was and can in future be ensured by first recognising stereotypes and then carefully selecting images that don't conform to stereotypical depictions. The group work element of the workshops is also important in enabling the students to consider multiple perspectives and critically reflect on what they have seen. Additionally care needs to be taken with the prompt questions to ensure that questions are not leading but instead encourage the students to think critically and form their own perspectives on the materials.

9.4.5. Group work

The literature suggests that the current generation of students find a peer-peer learning approach more credible than a teacher led learning experience (Oblinger and Oblinger 2005). This was confirmed in the study specifically by one student, whilst the majority of students responded well to the group work environment, describing how the group discussion encouraged them to consider different opinions and viewpoints. This agrees with the literature on the benefits of group work (Denton 1997) and collaborative learning (Kelly, 2010).

Furthermore, the group discussion enabled students to consider the opinions and viewpoints of others, recognising key attributes of the education for sustainability literature such as diversity through multiple (Li

and Williams, 2006) and multicultural perspectives (McNerney and Davis, 1996, Wals and Jickling, 2002). Recognition of multicultural perspectives was particularly evident and enhanced in the student groups containing international students.

Evidence of group discussion was abundant within all three workshops, but particularly in the 'Exploitation' workshop at UWIC, which featured a number of lengthy discussions amongst the MSc students. In contrast, group discussion was less detailed amongst the first year undergraduates at NTU, which could suggest that the workshops were most effective with more experienced students who have a solid grounding in design to add to. However, whilst this observation stands, the first year students reflected deeply on the content and, like the MSc students, also recognised the three pillars of sustainability within the 'Localisation and EDD' workshop. Therefore it would be fairer to conclude that each level of students managed to work at an appropriate level within the workshops with enough detail and scope to challenge a breadth of students from 1st year undergraduates to master's students.

The findings demonstrated student reflection on the conflicting views, which arose within the group discussion, especially in relation to the workshop on exploitation. Students recognised that there were often two viewpoints or arguments to a particular issue, grasping an important characteristic of the complexity of sustainability through demonstrating critical reflection (Wals and Jickling, 2002, Kelly, 2010, Huckle and Sterling, 1997).

9.4.6. Effectiveness of the workshop environment

This section will consider the wider relevance of the workshops.

Students individually and corporately noted the effectiveness of the 'Rethinking Design Series' workshops in the findings, particularly the style of the A/V introductions, validating the approach taken and the literature findings in section 2.3. The short length and simplicity of the A/V introductions, was particularly cited by students suggesting that perhaps the

length and simple nature of the A/V introductions was instrumental to the fostering of reflection, encouraging students to fill in the gaps corporately through the group's understanding and interpretation. This would agree with the literature which suggests 'Net Generation' learners prefer to learn through discovery (Oblinger and Oblinger, 2005b, Tapscott, 2009).

All three workshops were effective in eliciting personal responses from the students demonstrating how the students had contextualised their learning and begun to personalise their learning as described by Murray (2011) in the literature. However this personalisation of the literature can only be attributed to the workshop design in two of the workshops 'Step into my world' and 'Exploitation'. As students were specifically asked in the 'Localisation and Emotionally Durable Design' 'whether they relate to any of the Emotionally Durable design aspects presented personally and to share such examples with the group'. Whilst this question could be seen as invalidating any contextualisation made within the 'Localisation and EDD' workshop the question was asked to ensure that students grasped the concept of emotionally durable design and grappled with its meaning encouraging students to contextualise aspects such as emotionally durable design, personal meaning and reuse. However this question was only asked within the 'Localisation and EDD' workshop to help students grasp the complex nature of EDD and not in the other workshops.

The creative and applicable nature of the Localisation and Emotionally Durable Design A/V introduction particularly appealed to students due to the inclusion of existing examples. This suggests that design students find examples particularly useful to their understanding, an aspect that is echoed in the ecodesign literature (Lofthouse, 2001). This consideration of existing examples was also picked up on by the lecturers in response to the 'Rethinking Design series' workshops as particularly relevant to the students' learning.

Students cited the ‘Rethinking Design’ workshops as enjoyable and beneficial and described how the workshops had helped them broadened their thinking and outlook in respect to their design solutions. This suggests that the students were able to make connections between the workshop content and the design projects that they were undertaking at the time, addressing the issue of compartmentalising sustainability that was highlighted in both the literature (Ramirez, 2007a) and academic interviews in section 5.2.6. It was also evident that some students carried through developments from the workshops to their design projects both in and outside the module, with one group from LSBU designing multigenerational public seating to link a number of the individuals portrayed in the ‘Step into my World’ workshop. A lecturer at UL also described how a student had applied the learning from the ‘Localisation and EDD’ workshop in a separate module suggesting that the design of the workshops enabled students to apply the content in their practice and overcome the issue of ‘Box-in’ specialist learning that was identified in the literature (Ramirez, 2007c).

One lecturer suggested that students had been less successful in carrying through their learning in the ‘Localisation and EDD’ workshop than in the first workshop ‘Step into my World’, but noted that his may have been due to having the Christmas break in the middle of the module. However the researcher suspects that in this instance a strong focus on the life cycle assessment of their products within this project had diverted the student’s attention. This reductionist effect is recognised within the literature (Chapman, 2005, Millet et al., 2007) and described in section 2.4.6.

The main limitation of the ‘Rethinking Design’ workshops is that they were only introductory in nature. Whilst this was the intention of the workshops, it could also be a limiting factor as one of the lecturers highlighted that should the ‘Rethinking Design’ workshops be repeated by other lecturers they would require a good understanding of the subject area to be able to fully support students. Whilst this is a valid criticism, the interventions led to deep

learning and demonstrated that students can build upon the introductions to a deeper understanding, becoming independent learners.

9.4.7. Can an appropriate method foster a change in individual student's attitudes?

The design of the 'Rethinking Design series' workshops intended to create a deep learning response amongst the students involved, which can be characterised in part by student identification and contextualisation of the issues being portrayed in the A/V introductions either personally or professionally. The findings suggest that the 'Rethinking Design series' workshops fostered attitudinal change in both respects, with the students identifying with the issues as both designers and consumers. This supports the A/V approach used to create an indirect experience through the use of imagery (Murray, 2011).

Attitudinal changes were demonstrated in both the questionnaire and student diaries, with the follow up questionnaires demonstrating more positive attitudes amongst students toward social issues, in contrast to the traditional market driven design considerations. These improvements in attitude mirrored the focus of the workshops whilst the issues that decreased most in importance were not addressed in the workshops. Therefore it could be argued that the students were only relating their attitudes in the questionnaire specifically toward the experiences of the workshop. This ambiguity highlights one of the main limitations of the use of closed questions within the questionnaire, which provide only limited understanding. In contrast, the open response question at the end of the questionnaire was a far better indicator of change and was used by students as an opportunity to discuss designers' responsibilities and the long term effect of products on society. The nature of this response suggests that the students had related their attitudes to their future role as designers. Students also discussed whether a designer is responsible for the societal implications of the production phase, or the product's life, considering the use and end of life phases. They demonstrated a grasp of the holistic nature

of sustainability (Wals and Jickling, 2002), by considering cause and effect relationships (Kelly, 2010).

The student diaries permitted students to discuss the impact of the workshops and were less restrictive and more informative, providing greater insight than the questionnaires. The diary comments were also more valid as the individual students decided what they wanted to write about and so the content had more merit than a response to a question within the questionnaire. The diaries further supported the questionnaire findings regarding the ability of the workshops to foster attitudinal change, demonstrating how students had personified and contextualised issues by considering their responsibilities both as designers and consumers.

Students also considered how their lives related to the individuals portrayed in the A/V introductions, noting how different their cultures were and how lucky they felt as a response to what they had seen. This ability to expose students to cultures and experiences beyond their own and enable them to link it to their real world experience was noted as a key benefit arising from the inclusion of music in the literature (Albers & Bach, 2003; Brkich, 2012). This widening perspective also demonstrates that the workshops had enabled students to recognise the multicultural nature of sustainability (McNerney and Davis, 1996, Li and Williams, 2006, Wals and Jickling, 2002), by helping them to look beyond their own experiences and understanding.

Students commented on how they were moved by the examples of products that they take for granted being made by exploited workers and how they had no previous insight into the hardship involved. Students also related their experience of the workshop to their future outlook, with a number commenting on the eye-opening nature and their changed focus as a designer and a student noting that they wouldn’t want to work for the companies involved in exploitation.

Therefore it would appear that the ‘Rethinking Design’ workshops encouraged students to ask questions about their attitudes as designers and consumers and to some was pivotal in considering their future actions as a designer.

9.5. Foster Deep Learning in respect to the social aspects of SPD.

The literature discussion in section 2.1 on Education for Sustainability demonstrates links with deep learning, collaboration and critical reflection therefore the following section will also consider how these attributes featured in the analysis of the student workshop experience.

9.5.1. Collaborative Reflection

Analysis of the student responses to the ‘Rethinking Design Series’ workshops were undertaken as four separate stages including the questionnaires, individual responses to the A/V introductions, group discussion and mind mapping during the workshop and at UL the individual student diaries.

The individual responses conducted immediately after the A/V introductions, demonstrated mainly surface level observations, which typically lacked reflection. However, deep level responses were made in the group based workshop session and were reflected upon and developed later in the individual students’ diaries. It is the researchers understanding that the individual responses benefited from the group discussion and the opportunities for critical reflection that this offered, with students responding to their own and others’ suggestions.

This differentiation between the individual responses and group based sessions would suggest that group work, group discussion and mind mapping were key aspects in encouraging students to engage with the material at a deeper level and begin the transition from surface learning to deep learning, supporting the design of the workshops and literature

findings by encouraging critical reflection (Vaughan, 2006, McMahon, 2006, Entwistle, 2000, Gokhale, 1995), collaborative learning (Entwistle 2000; McMahon 2006; Vaughan 2006), learning by discovery (Warburton, 2003) and enabling students to internalise their learning through sharing with others (Tapscott, 2009). It could be argued however, that the progression in the students' level of thinking could be attributed to length of time granted at each stage as the students were typically only given 5 minutes for the individual response, whilst 40 minutes was allowed for the group discussion and mind mapping exercise. However, as section 7.5.1.1 explored, the students also personally recognised and reflected upon the benefits of the group element.

The workshops and diaries showed that students had reflected widely on the aspects explored within the workshops, by exploring related issues that had emerged from the group discussion. An example was identifying specific issues such as the effect of technology growth upon the elderly. This suggests that the students had considered more deeply the needs of the elderly and sought to address issues beyond those alluded to in the A/V introduction. This implies that this issue arose through the group discussion and collaborative reflection, with individual students perhaps applying previous knowledge or experience to the activity as recognised highlighted by the literature in section 2.2.1.

The following sections will explore how reflection and design thinking demonstrated deep learning within and beyond the workshops.

9.5.2. Individual Reflection

Whilst collaborative reflection was useful in fostering critical thinking, students also exhibited individual reflection in two of the data collection methods: the questionnaire and student diaries.

Students typically found that the questionnaires were beneficial to them because of the ability to reflect upon what they had learnt. This was an unexpected outcome of the research as the questionnaire was initially

intended solely as a data collection and measurement tool. Students initially reflected on the questions, identifying aspects that they didn't understand, with the view to ensuring that they recognised them at the end of the workshop and later in the second questionnaire students reflected on how their thoughts, perceptions and knowledge had changed.

The student diaries from UL were very beneficial and like the questionnaires, acted as a form of data collection and a continuation of the student's learning. Within the diaries students personally reflected on the workshops in terms of their own lives and outlook, suggesting that they had been able to personalise aspects of sustainability (Murray, 2011) and through such reflection students managed to unravel the complex macro themes, recognising the holistic nature of sustainability (Wals and Jickling, 2002).

Additionally, the student diaries permitted the students to continue to reflect subconscious in the time taken between completing the workshop sessions and writing up their diaries. This continuous reflection over time is similar to the description of the way designers think through the incubation of an idea (Glegg 1969; Whitfield 1975; Lawson 2006).

9.5.3. Design Thinking

Students demonstrated design thinking in both the workshops and diaries, using their creativity and knowledge to resolve issues outside of the remit of the traditional designer. Therefore despite Warburton's (2001) assertions that a strong discipline-specific focus can harm the potential for deep learning, students from a single discipline background managed to recognise the interdisciplinary nature of sustainability and consider solutions outside of their discipline focus. The success of the 'Rethinking Design Series' workshops in fostering design thinking agrees with literature, which notes that brainstorming and reflection are key components to enabling design thinking (Seidel and Fixson, 2013).

The students design thinking approaches considered macro issues of worker inequality, suggesting solutions to raise consumer awareness that included labelling to permit traceability and corporate transparency. The later requiring the outsourcing of manufacturing in the developing world to become a public procedure, promoting transparency and good practise. Both examples were suggestive of a service based approach to problem solving, which is an important recognition in the shift to a sustainable mind-set, from products to service based solutions (Morelli, 2003).

In addition to adopting design thinking skills, students began to consider and discuss the need for a redesign at a systems level approach to address the issues covered in the workshops. This recognition demonstrates a grasp of the complexity of sustainability and the requirement for a systems approach to thinking as noted in the education for sustainability literature (McNerney and Davis 1996; Huckle and Sterling 1997; Wals and Jickling 2002; Cortese 2003; Warburton 2003; Li and Williams 2006; Henry-Stone 2010).

9.6. Breadth of the research study

A key consideration of this research study was that it would produce findings that can inform the wider teaching of social aspects within SPD in the UK. A limitation described by Clunes (2009) and also inherent in Cull's (2005), doctoral research studies, as both studies used localised samples. Cull's (2005) study considered interventions at two Scottish universities, whilst Clunes' (2009) study considered the impact of teaching at a sole Australian institution, University of Western Sydney.

This research study considered a far wider sample throughout all three stages with representatives from 29 universities in the UK (England, Scotland and Wales) responding to the nationwide survey and academic interviews being conducted with 9 academics throughout England and Ireland. Finally the main study workshops were conducted in 5 institutions: one in Ireland, one in Wales and three in England, with a student population that is representative of the UK student population in regards to social

background data obtained from HESA as explored in section 3.6 and table 5 as well as geographical background. With the student questionnaire results presenting a widespread representation in the student sample across the countries in England, Wales and Ireland as demonstrated below in Figure 26.

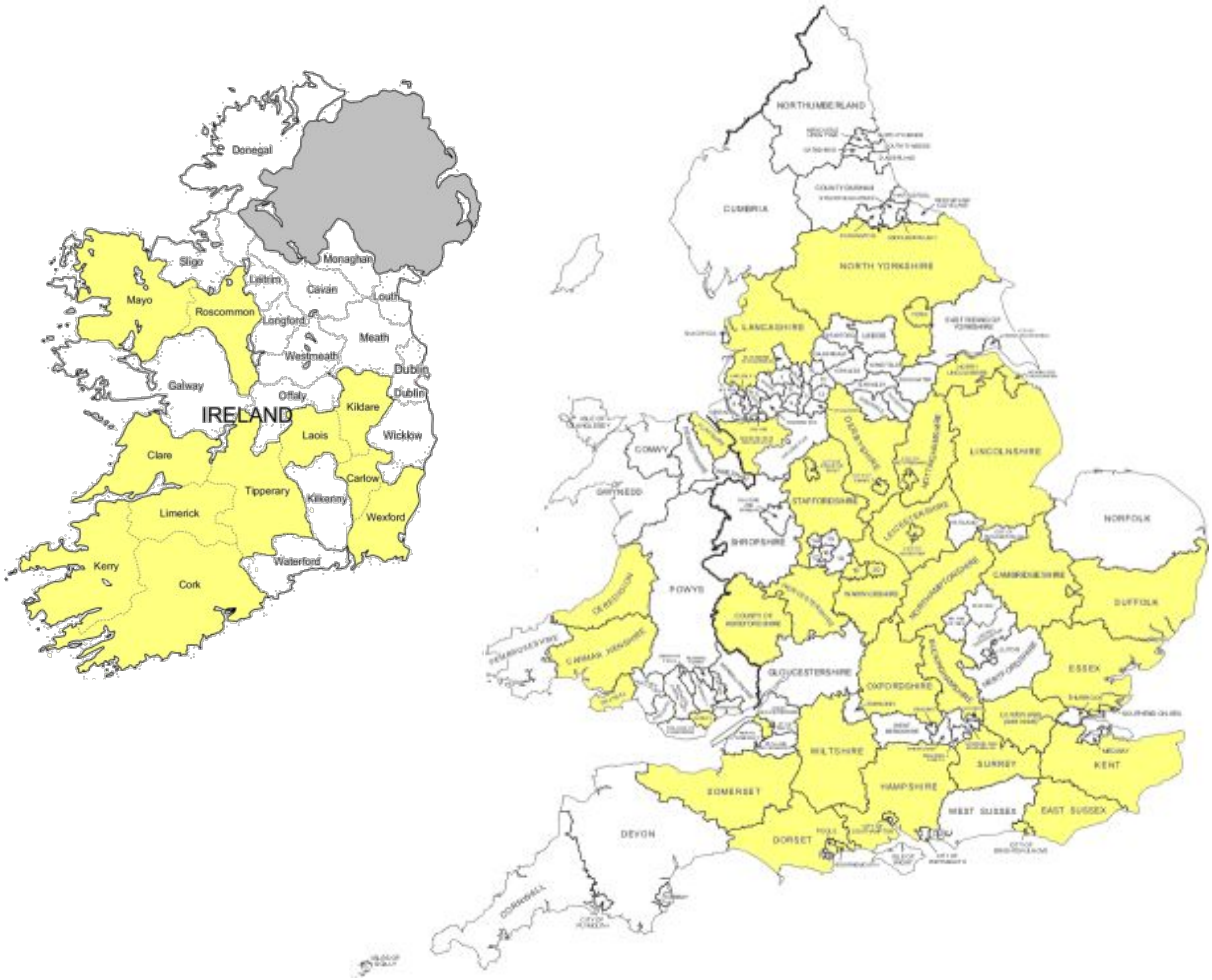


Figure 26 England, Wales and Ireland maps showing student home counties

The participation of a number of international students from Europe and Asia also helped to represent the international nature of higher education within the UK and added multicultural awareness and understanding of sustainability to the workshops.

Whilst this study doesn't represent a global study like Clunes (2009) alludes to in the discussion of the limitations of his doctoral study, this study does represent the majority of the UK and Ireland, with the main exception being the lack of Scottish universities within the main study. The researcher is

aware that a global study would be very difficult to achieve logistically as well as presenting inherent difficulties due to differences in the culture, teaching styles and curriculum structures of different countries. The three countries represented in the ‘Rethinking Design series’ workshops share a common language, have a similar in culture and all share a number of similarities in their course structures.

The ‘Rethinking Design series’ workshops will be made freely available following this research study, however whilst the format was successful in 5 universities across a range of levels, the researcher doesn’t suggest that the workshops present a one size fits all approach to the fostering of a holistic understanding of the social aspects of SPD. Rather, the workshops represent a container for the key elements needed to create a learning atmosphere where students can creatively explore the social aspects of SPD through reflection, personalisation and collaboration. This thesis seeks to explain how this can be achieved. Hoping to inspire academics through the approaches outlined, to develop their own resources, which specifically meet the needs of their individual courses, to ensure that the resources are relevant a vital aspect in fostering deep learning.

Chapter 10. Conclusions

10.1. Meeting the Research Aims and Objectives

The aim of this research study was to develop an approach for the successful teaching of social sustainable product design within UK and Irish universities. This was achieved through the fulfilment of the following objectives originally identified in section 1.3.

Objective 1: - To conduct a review of the literature surrounding the intended research study, to investigate the current state of the art in the field.

A literature review as presented in Chapter 2, was conducted; addressing the needs and requirements of Education for Sustainability, the learning preferences of designers and the current generation of students, existing examples of SPD education and a multidisciplinary review of the definition of social sustainability and social design and a consideration of the benefits and disadvantages of group work in design education.

Objective 2: - To conduct a nationwide survey to investigate the state of sustainable product design education within the UK, seeking to address gaps evident in the literature review.

Chapter 4 describes the findings of a nationwide survey that was undertaken amongst lectures of 3D Design courses including Product and Industrial Design across the UK to investigate how widely SD is addressed, understood and implemented. The findings of this study were presented at, and published in the international conference proceedings of Engineering and Product Design Education (Watkins and Lofthouse, 2010).

Objective 3: - To identify both best practise and limiting factors for the successful delivery of sustainable product design education by conducting interviews with leading academics in the field.

Chapter 5 described the findings of 9 academic interviews conducted to explore existing best practice in the teaching of SPD and discover any limitations or specific observations that the experts had in respect to SPD education.

Objective 4: - To develop and implement effective educational interventions in product design courses that help to facilitate an understanding amongst undergraduate students of the social aspects of sustainability and encourage students to consider these within their design practise.

Chapter 6 details the development of the 'Rethinking Design series' workshops. Three workshops were developed in total and conducted at 5 universities in the UK and Ireland. Multiple forms of data collection were employed including student observation, questionnaires, analysis of the outcomes and diaries and lecturer interviews. The effectiveness of these workshops is detailed within Chapter 7 which presents the findings from the UL workshops and Chapter 8 which presents the findings from the supporting studies workshops.

Objective 5: - To evaluate the effectiveness of these interventions in enabling students to fully understand and consider the social aspects of sustainable product design within their assessed outcomes.

Chapter 9 discusses the findings of the 'Rethinking Design series' workshops in respect to the relevant research questions, considering how the workshops answered the research questions.

Objective 6: - To draw conclusions from a wide sample so that the findings can inform and enhance future teaching and learning in SPD within British and Irish universities.

Chapter 10 presents the conclusions from this research study.

10.2. Conclusions of the Thesis

The 'Rethinking Design series' workshops were designed and developed based upon the conclusions arising from the 1st and 2nd research stages in conjunction with the literature review. The conclusions that were drawn at each stage, also, in some cases, complemented the subsequent research stages, helping to focus the research.

This section outlines the key conclusions that can be drawn from the research study.

The findings relating to the teaching of the social aspects of SPD found:

- That both the literature review and the nationwide survey highlighted a lack of understanding amongst academics about what the social aspects of SPD are.
- A lack of teaching and consideration of the social aspects of SPD in students' projects, highlighted in section 2.4.5 of the literature and the nationwide survey in section 4.2.2.
- That the social aspects of SPD are more difficult to teach and understand than the environmental aspects of SPD and require addressing through different teaching approaches, as described in section 5.2.3 of the academic interviews.
- A small group approach is preferable when teaching the social aspects of SPD permitting peer discussion, debate and informal peer assessment as described in section 5.2.3 and supporting literature in sections 2.1.2.1 and 2.2.2.1.
- That a small group approach is also important in developing deep learning, fostering critical thinking through peer debate and critical reflection, see section 5.2.4.
- A preference for visual resources, in section 5.2.5, which agreed with the literature findings in sections 2.1.3, 2.2.2.1 and 2.3.2.

Recommendations for the teaching of the social aspects of SPD, suggested:

- A holistic approach, rather than the applied approach commonly used in addressing the environmental aspects of SPD as described in section 5.23.
- Opportunities are made for group work and student reflection, particularly in small groups as highlighted in section 5.2.3 to enable student interaction and foster deep learning, a key characteristic of education for sustainability as identified in section 2.1.4 of the literature.
- The importance of encouraging critical thinking and reflection through group work, student discussion and debate and questioning were also identified in sections 5.2.2 and 5.2.4, supporting the literature in sections 2.1.2 and 2.1.3.
- The use of visual approaches was also identified as important in both the academic interviews in section 5.2.5 and literature sections 2.1.3.1, 2.2.2.1 and 2.3.2 as beneficial to students' learning.

Findings relating to the effectiveness of the 'Rethinking Design series' workshops concluded that:

- The use of carefully considered audio visual materials and group based interaction encouraged students to consider the social aspects of SPD holistically in relation to their practice.
- The audio visual method used within the workshops was described as relevant, effective and even enjoyable by the students. Agreeing with the literature in section 2.3.
- The A/V introductions in conjunction with the accompanying workshop questions encouraged student reflection.
- The group based focus encouraged students to examine their own interpretations and those of their peers critically by fostering discussion and debate in response to each A/V introduction. This collaborative element led to a consideration of different perspectives and fostered critical thinking.

- The workshop methods fostered a relevant approach which encouraged students to adopt deep learning responses to sustainability, despite the strong discipline specific environment, negating the concerns of Warburton (2001).
- The workshop format encouraged students to explore social SPD holistically, fostering design thinking approaches.
- The design of the workshops encouraged students to personalise sustainability and change their attitudes in respect to their outlook, both as designers and individual consumers.
- The ‘Rethinking Design series’ workshops went beyond the traditional transmissive learning model, where students evidence surface learning, to a transformational learning experience with evidence of students demonstrating deep learning.
- The ‘Rethinking Design series’ workshops were successful in fostering a consideration of multiple aspects of SPD, including personalisation, critical thinking and deep learning, which led students to adopting new approaches in relation to the material.
- This consideration of multiple social aspects of SPD within a relatively short space of time, addressed concerns raised by academics of the overwhelming nature of the social dimension of sustainability in an overcrowded product design curriculum.
- Students demonstrated an ability to relate the content of individual ‘Rethinking Design series’ workshops to a wider understanding of sustainability, identifying the economic, environmental and social aspects.
- The workshops represent a container for the key elements needed to create a learning atmosphere where students can creatively explore the social aspects of SPD holistically through reflection, personalisation and collaboration. Rather than representing a one size fits all approach to the fostering of a holistic understanding of the social aspects of SPD.

10.3. Contribution to Knowledge

This PhD has combined a number of successful approaches into SPD education in a way that has not been documented before. Whilst a number of the individual findings agree with existing theory, for example the positive response to the audio visual methods agreeing with literature detailed in section 2.3 and Murray's (2011) use of images to personalise aspects of sustainability, it is the combination of multiple approaches and the new discipline focus within product and industrial design that is novel and unique. Such a holistic approach to the consideration of the social aspects of SD within the disciplines of product and industrial design is unique, with much of the pre-existing focus solely related to the environmental considerations. This PhD has addressed the social dimension of SPD in a holistic manner that encourages students to adopt attributes of sustainability such as critical reflection, deep learning, personalisation, systems thinking, collaboration and different perspectives. Furthermore, this PhD has explored all of the above in a focus that is specific to UK and Irish universities and is the first PhD to consider the teaching of the social aspects SPD in this context across multiple institutions.

This PhD specifically addresses numerous gaps in the literature surrounding SPD education as identified in section 2.6.2:

- A survey of sustainable product design education was conducted with respondents representing academics at 60% of the universities in the UK that teach product or industrial design as detailed in chapter 4.
- A set of social SPD criteria was identified as detailed in section 6.1, and whilst these cannot be described as definitive and will be subjective to future peer review, these criteria were identified through a wide reaching multidisciplinary literature review and interviews reflecting the opinions of leading academics within the field.
- This PhD provides a description of implementing social SPD education in multiple universities within the UK in chapter 8 and Ireland in chapter 7. Previous publications documenting UK

universities sources lacked consideration of the social aspects of SPD and typically focussed on single institutions.

Furthermore this PhD has explored how a range of techniques can be employed effectively within SPD education at postgraduate and undergraduate levels within the UK and Ireland and provides academics with a replicable approach that is relatively simple and doesn't require additional resources, tools or software beyond the scope of a lecturer's own individual preparation.

10.4. Limitations within the Research

The PhD has successfully addressed gaps and limitations in the existing literature. However, limitations still exist within this study due to student access and these are explored below.

10.4.1. The effectiveness of workshops at different levels

The relative effectiveness of the 'Rethinking Design series' workshops for students at different levels was discussed within Chapter 9, however a greater sample of students at a Masters level would have been required to draw any definitive conclusions upon this. Initially the researcher highlighted 2nd year undergraduates as the intended focus. The researcher decided that he didn't want to involve 3rd year students in the study in case it interfered with or affected their final year of study and initially felt that 1st year students would lack the depth of grounding in the subject area to question or 'Rethink' design approaches effectively. However the student sample was limited to the range of students made available at the universities involved. UWIC, which was considered important to the study for the consideration of the perspective of a Welsh university, only offered the opportunity to work with MSc students, which was seen as an opportunity and provided important data rich findings, however the workshops at UWIC were conducted late and there wasn't time, funding or resources to investigate additional Masters courses at other institutions for comparison. Similarly NTU were only able to offer 1st year students for inclusion in the research due to timetabling and staffing, however the inclusion of the students at NTU

allowed a greater number of students to be considered due to the much larger group sizes on their BA course in comparison to the BSc courses at the other institutions. Therefore comparison between the 1st and 2nd year students was more robust as the sample sizes were similar. It would still have also been desirable to include another BA course, to permit direct comparison between the BSc and BA students; however this wasn't available within the sample.

10.4.2. Breadth of the research study

The research study sought to produce findings that are relevant to all universities teaching SPD in the UK and Ireland, however Scottish universities whilst represented within the nationwide survey, were not represented in the main study. Furthermore there was a complete lack of Scottish students represented in the 'Rethinking Design series' workshops as illustrated in Figure 26 shown in section 9.6. Whilst it would have been ideal to have included the perspective of a Scottish university and students, the researcher was limited by distance and a willingness to participate.

10.4.3. Workshops' influence on students' practice

Ideally it would have been useful to have explored whether the workshops affected the students' projects or essays in the requisite modules. However, whilst this was initially conducted for the students at LSBU, access wasn't permitted or the outcomes were inappropriate for analysis at every institution. For example, the second project undertaken at LSBU for Reuse, Reduce, Recycle was heavily environmentally focussed and LCA driven. Similarly the project at UWIC had a fixed brief and outcome that related to an innovative use of recycled materials. Therefore these project outcomes didn't permit consideration of the social factors because the briefs and outcomes were too constrained, as considered within section 2.4.3.2 of the literature.

The research also found that a review of the projects at LSBU required a detailed understanding first of the students' prior knowledge before assumptions could be made in linking the development of concepts to the

workshops. Such an undertaking would therefore need to be conducted in an environment where the researcher had constant access to the students throughout the duration of the project to be able to ascertain with relative certainty the origin of ideas.

10.4.4. Ability to undertake a longitudinal study

As noted above in section 10.4.3 the limited access to students made it difficult to ascertain the workshops influence on students practice. Ideally the workshops would be conducted by a staff member that had access to the students throughout the module and preferably throughout the course. A longer study would have permitted the students outcomes to be tracked beyond the module and throughout the rest of their course, and this would be able to confirm more accurately whether the workshops had enabled the students to overcome the 'box-in' mentality (Ramirez, 2007c) as described earlier in section 5.2.6. Additionally this would also have permitted testing Murray's (2011) theory regarding personalisation further to determine whether the student's attitude changes were permanent or merely temporary.

A longer study would also have permitted an action research approach to be adopted with the workshops, permitting a number of cycles of repeated trialling, refining and development of the resources and experience. Both Cull (2005) and Clunes (2009) used such an approach within their studies as it is ideally suited to educational research. An action research approach requires continued access to students, which was possible in both Cull's and Clunes case studies, which were conducted at their home institutions. However, continued access to students was not possible in this study due to access. Furthermore an action research approach should ideally be used on the same level of students in the same institution, which was not possible in this study due to the differences in levels involved. An action research approach also would have limited the number of studies manageable and therefore not permitted generalisations to be made across the institutions, as the refining process would mean that each institution would have had a different experience. However as noted in section 6.2.2, each workshop was

subject to a level of refinement, as each was first piloted with undergraduate and postgraduate students at Loughborough University and modified accordingly before being conducted at each of the 5 institutions.

10.4.5. Impact of student's prior knowledge

A key difficulty in the study, introduced briefly in 10.4.3 was the ability to account for student's prior knowledge of the subjects addressed within the workshops and the potential effects this could have upon the validity of the findings. Such prior knowledge could result from previous or concurrent teaching or through exposure external to the academic environment, through the media or a student's own interest.

Prior exposure to such content outside of the academic environment is very difficult to measure, control or gain any certainty over. However the student questionnaires sought to uncover any disparities in student knowledge by asking students to indicate their knowledge of key terms, an example of the first questionnaire is shown in Appendix K. However despite this measure, there was still potential for variability, as a student may not recognise a particular keyword but could perhaps have a familiarity to related subject matter under a different name.

Students exposure to prior learning within the academic environment was considered were possible and noted within the institution introductions and background information given for each case study in sections 7.1 & 8.1. With baseline information derived from module guides, and lecture content and understanding of when sustainability was delivered in the courses from the academic questionnaire Ch4 and interviews in Ch5. However this baseline was limited to the information that the research had access to and this varied between institutions. The ability to construct a baseline of understanding of students learning in the module surrounding the 'Rethinking Design' workshops was greatest at UL and LSBU. This is where the researcher had access to a greater range of module materials and lecture content and was able to ask more detailed questions of the lecturers through interviews and emails both prior to and following the workshops.

This enabled firmer findings and conclusions to be drawn in relation to these particular cases.

As noted previously in section 10.4.3 & 10.4.4 consistent access to the students as a member of academic staff, would have addressed these limitations relating to access, but this in turn would have limited the breadth of the study to only a single institution. On reflection, the collection of reflective student data that related to individual student experiences, such as the diaries conducted at UL would have preferred at every institution involved. The use of diaries at each institution would have been an alternative to the individual student interviews, which were planned for the study, but proved unfeasible to arrange due to access and distance between the researcher and students.

10.5. Recommendations for Further Work

Whilst this research study is complete there were a number of interesting findings arising from this research study revealing a number of potential avenues of exploration. However, there was insufficient time and resources within the PhD to address these. Further work could include the following:

- A study considering how social SPD can be addressed through a design studio environment as indicated within the academic interviews.
- A feasibility study to consider the potential for integration of sustainability within the core Product Design curriculum as a response to this recommendation from the nationwide academic survey.
- A study considering how social aspects of SPD could be taught in an interdisciplinary way, reflecting a key recommendation of section 2.1 (education for sustainability).
- A fourth ‘Rethinking Design’ workshop was considered that would have touched upon aspects of Design for Behaviour Change as noted in section 6.1 and design for community and wellbeing. The

workshop would have communicated aspects such as a breakdown in the local community and face to face communication due to advances in technology, using Pink Floyd's track 'Keep Talking' (Gilmour et al., 1994). The workshop was not fully developed as it was decided that 3 workshops was sufficient and it would be difficult to trial all four in any one institution but this could form an additional future workshop in the series.

- A longitudinal study considering how the workshops affected students' future work would have been an interesting undertaking, but was beyond the scope of this study. This could be investigated through a smaller sample in future lecturing opportunities.
- The findings from this research study should be disseminated to those academics involved within the study as a gesture of goodwill and to enhance the teaching of the social aspects of SPD in UK universities further. The researcher intends to address this through publication in a journal and relevant conference presentations with the intention of seeking funding to run a symposium for the dissemination of the findings to interested parties involved within the study.

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APPENDIX A. UNIVERSITY COURSES

The table below outlines product and industrial design undergraduate and postgraduate, which cover sustainable design in their course structure and state whether it is an optional or compulsory element and in, which year level is it covered. This data was taken for courses to commence in summer 2009.

University	Degree type and title	Related modules	Year
Anglia Ruskin University	BSc (Hons) Sustainable Design and Innovation	Rethink, Recycle, Redesign	2nd
		Virtual Environments	3rd
Aston University	MSc Product Design Innovation	Sustainable Futures	
	BSc Sustainable Product Design	Sustainable Process Technology	1st
		Energy Efficiency	3rd
		Environmental Management and Audit	3rd
		Green Building	3rd
		Design Project (Sustainability - optional)	3rd
	BSc Product Design & Management	Sustainable Process Technology	1st
		Environmental Management and Audit	3rd
		Design Project (Sustainability - optional)	3rd
	BSc Engineering Product Design	Sustainable Process Technology	1st
		Energy Efficiency	3rd
		Environmental Management and Audit	3rd
		Design Project (Sustainability - optional)	3rd

Bangor University	BSc (Hons) Product Design	Sustainable Development	
Bournemouth University	MSc Sustainable Product Design	Design for Waste Minimisation Sustainable Product Design Interlocking Nature of Sustainability	
University of Brighton	MA Sustainable Design	No detail given	
	BSc (Hons) Sustainable Product Design with professional experience	No detail given	
Brunel	BA (Hons) Industrial design and Technology	Design for Manufacture Environmentally Sensitive Design Human factors Contextual design	2nd 3rd 3rd 3rd
	BSc Product Design	Design for Manufacture Environmentally Sensitive Design Human factors Contextual design	2nd 3rd 3rd 3rd
	BSc Product Design Engineering	Design for Manufacture Environmentally Sensitive Design Human factors Contextual design	2nd 3rd 3rd 3rd

	MSc Integrated Product Design	Design and Innovation Futures Professional Design Studio Design Research, Creativity and Innovation Sustainable Design	
Derby University	BA (Hons) Product Design	Environmentally friendly design and innovation	2nd
	BSc (Hons) Product Design, Innovation and Marketing	Product Design for Manufacture Strategies for Ecodesign (optional) Product Design Culture Management of Ecodesign (optional) Applied Ecodesign (optional)	2nd 2nd 3rd 3rd 3rd
	MSc Sustainable Design and Innovation (manufactured products or built environments route)	Designing for People Design for Recycling and Reuse Innovation in Sustainable Design Managing Environmental Design Sustainable Design Ethics	
Goldsmiths	MA Design Futures	Ethics and the Environment Society and the Individual Culture, Technology and Change	
	MA Design and the Environment	Design and Environment Researching Design and Environment	
	BA (Hons) Design	Contextual studies	1st

		Responsibilities as a designer	2nd
University of Hertfordshire	BA (Hons) Product Design or Product Design with Marketing	No module titles given but includes: Sustainability as social, economic and ecological issues & User centred design	
University of Huddersfield	BA(Hons) Product Design: Sustainable Design	Sustainable Design Issues	2nd
Kingston University	BA(Hons) Product and Furniture Design	Sustainable futures module	2nd
Liverpool John Moore's University	BSc (Hons) Sustainable Design	Sustainable Development Sustainable Product Design Workshop Testing Product Performance Pollution of land, sea and air Environmental Regulation and Practise Sustainable Design Environmental Management (optional) Designing against Failure (optional)	1st 2nd 2nd 2nd 2nd 3rd 3rd 3rd
London South Bank University	BSc (Hons) Product Design	No module titles given but includes: Environmental impact of products, product life cycles and 'alternative' technologies & understanding people's needs, ergonomics and inclusive design	

Loughborough University	BSc (Hons) Product Design and Technology	Ergonomics for Design Sustainable design (optional) Universal Design (optional)	1st 2nd/3rd 3rd
	BA (Hons) Industrial Design and Technology	Ergonomics for Design Sustainable design (optional) Universal Design (optional)	1st 2nd /3rd 3rd
	MA/MSc Sustainable Product Design	Sustainable Design User centred Design (optional)	
Northumbria University	BSc (Hons) Product Design Technology	Design for Manufacture - Including Design for X	4th
	(BA Hons) Design for Industry	Contemporary Influences on Design 1	1st
		Contemporary Influences on Design 2	2nd
		Technology, Culture and Design After 1900	
		Contemporary Influences Dissertation Preparation (option)	3rd
		Contemporary Influences Dissertation Presentation (option)	3rd
University of Nottingham	Product Design and Manufacture MEng	Ergonomics in Design Conservation and Recycling of Materials (option)	2nd 3rd/4th
University of Teeside	BA (Hons) Product Design (Futures)	Product Design Issues and Contemporary Theory Design for Inclusive and Sustainable Futures	2nd 2nd
	MSc Design	Sustainable Design	

University for the Creative Arts (UCA)	BA (Hons) Product Design Sustainable Futures		
	MA Sustainable Product Design		
University West of England (UWE)	BSc (Hons) Creative Product Design	Design, Materials and Processes - includes ergonomics, inclusive design, sustainable design	1st
UWIC University of Wales Cardiff	BA/BSc Product Design	Product usability & interface design Sustainability, trends, career opportunities	2nd
	MSc Advanced Product Design	Sustainability Issues in Design for Production	

APPENDIX B. TOOLS USED IN SPD EDUCATION

This section will detail common design tools either used or widely available for use within SPD education. Whist the majority of the following tools are environmentally based their inclusion is considered important as literature supports the use of several of the tools in the sustainable design module at Loughborough university and therefore can potentially affect the overall research study at least passively if not actively. The use of ecodesign tools at other universities is unknown so the researcher has included those that are typically available, using Delft universities wiki (Delft, 2008) and a Loughborough publications (Bhamra and Lofthouse, 2007, Lofthouse, 2009, Trimingham et al., 2008) as additional guides.

Ecodesign Tools

This section will consider various ecodesign tools, which are available to students and suitable for use in undergraduate and postgraduate education, many of the tools selected for this section are described in the 'Toolbox of Sustainable Design Education' (Bhamra and Lofthouse, 2004) a web based resource from Loughborough University for lecturers teaching on undergraduate and postgraduate courses in engineering and design. Other tools have been selected because of their association with undergraduate and postgraduate education overseas such as the tools described on Delft University of Technology's wiki for the Faculty of Industrial Design Engineering (Delft, 2008), whilst other tools have been selected for their free availability such as Greenfly.

The various ecodesign tools that are available can be split into three types:

- lifecycle assessment (LCA) tools,
- template based tools,
- guidelines and checklists

These classifications are merely intended to aid structure and allow a general description of the benefits and limitations of each type of tool to be made. As no literature has been found on effectiveness or widespread use

of any of the specific tools presented, which supports the findings of O'Rafferty (2008). However some of the tools presented could be considered in more than one of these categories.

Lifecycle assessment (LCA)

Lifecycle assessment (LCA) considers the environmental impact of a product at each of its life stages including the; material extraction, manufacture of the product, distribution of the product, resources consumed in the use phase and the eventual disposal considerations. LCA is recognised as the most accurate quantitative method for measuring a products environmental impact. The tool is often software based and impact values are calculated based on the specific materials and processes involved in the lifecycle of the product, weights and quantities required are multiplied by these values and an overall score is calculated. LCA is useful in identifying the key impact areas and the materials, processes or phase with the largest impact. LCA can also be used in comparative exercises to determine the most environmentally preferable iteration of a product.

However LCA is a complex tool, which often requires a large amount of data on the product. Such data is typically not available until the product has been fully realised in a manufactured product or in the detailed design stages (Millet et al., 2007). However it is considered beneficial to optimise the environmental impact, whilst a product is still in the design stages (Marosky et al., 2007), this is supported by (Lewis et al., 2001) who states that most of the environmental impact of a product is 'locked-in' during the design phase. Therefore LCA is typically used to by designers to guide future redesign or for comparison of the current product with previous generations or a competitor's product (Bhamra et al., 1999). Millet et al., (2007) however suggests that LCA tools should not be used to compare two products that have different functionalities or an existing product with a virtual product as this will reveal number of issues such as interpreting data, lack of product data and achieving reliable and accurate information. Therefore Millet et al., (2007) assert that LCA tools are only applicable in the

comparison of products with the same functionality of the assessment of a lone fully defined product.
Efforts have been made to integrate LCA tools earlier into the design process by suggesting that CAD data is analysed by LCA software so that the design could be analysed and perfected before the product reaches production. Marosky et al., (2007) highlighted the current barriers to this approach as incompatible file formats and the difference in the software models. However the larger CAD companies are beginning to work with existing producers of LCA tools to integrate LCA into the CAD package such partnerships include Autodesk working with Sustainable Minds and Solidworks working with PE the makers of GABi.

LCA tools can limit designers, by restricting their creativity, responsibility and initiative by imposing a methodological approach to the design process (Millet et al., 2007). Due to this Millet et al., (2007) concludes that LCA tools can therefore not be considered a design tool and that its role should be limited to that of an expert tool by an specialist individual or department. Quantitative tools by their nature and because of the higher level of accuracy involved require more time and expertise (Le Pochat et al., 2007). Charter (2001) identified this suggesting that there is a growing trend of moving away from detailed full life-cycle assessment towards more streamlined and simplified ecodesign tools because of the cost and time implications of the detailed lifecycle assessment tools (Tischner, 2001).

Eco-Indicator 99

Eco Indicator is an ecodesign tool, which uses LCA principles but allows for the assessment of a product in a fraction of the time that it takes to complete a full LCA assessment. Eco Indicator is included in the tools suggested and described in the ‘Sustainable Design Toolbox’ (Bhamra and Lofthouse, 2004) and is taught on both the both the undergraduate and postgraduate courses taught in the design and technology department at Loughborough University.

Eco Indicator 99 was developed by PRé Consultants, succeeding the previous assessment software Eco Indicator 95. Eco indicator can be conducted as a paper based exercise or by using the ECO-it software and both forms of are supported by the Eco Indicator 99 manual. The manual describes how to complete the assessment and lists the indicator scores for the materials, production processes, energy usage, transportation and disposal. Energy usage impact values vary and are dependent on the type of fuel used for electricity generation in each European country.

ECO-it Software

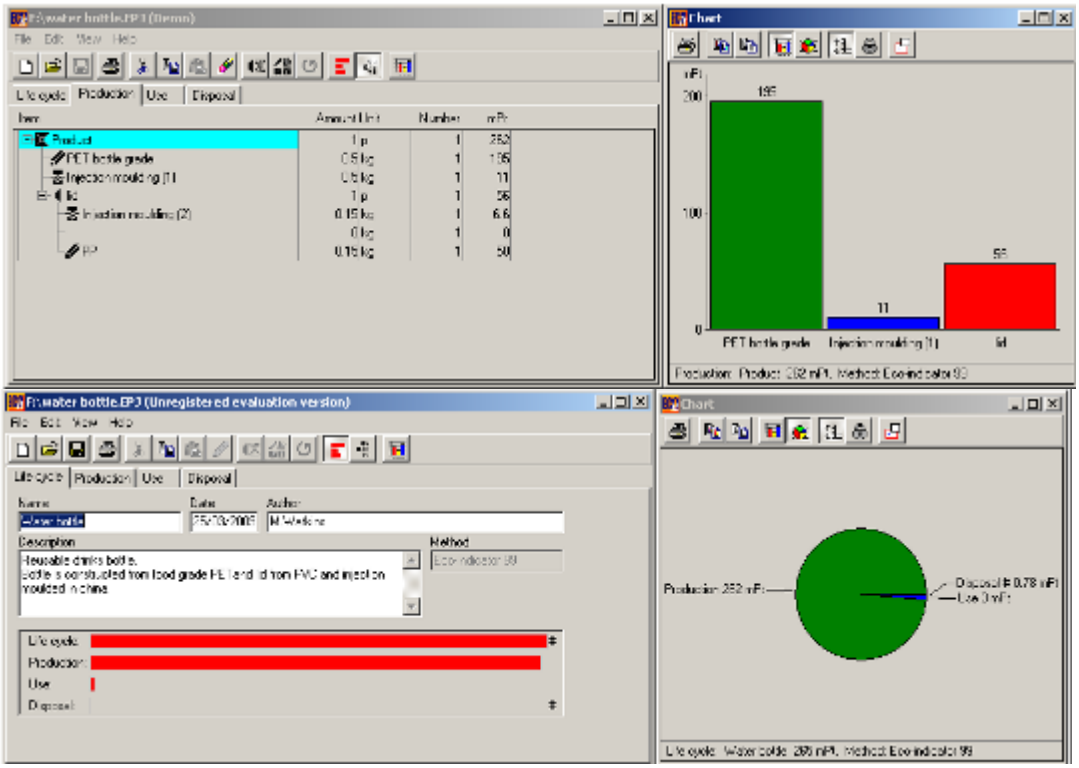


Figure 27 Screen shot from Eco-it software (PRé Consultants, 2009)

The tool works on the premise that the product is disassembled into single material parts identified and weighed. The weight in kg is then multiplied by the material indicator score and processing values to produce an aggregate value for each component. Disposal values are also calculate from the weight and the disposal indicator score and values such as transportation and energy use are also calculated giving a combined value in millipoints (mPt's).

The key areas for improvement can then be identified and addressed in a redesign scenario, an example of this is shown below. Hair styling tongs were assessed and the production and disposal stages are shown below with the initial and redesign outcomes. By replacing the thermo-set plastic casing with a recyclable thermoplastic casing and a ceramic washer for heat proofing, reduced the score significantly at both the production and disposal stages.

Greenfly

Greenfly was developed by a team of academics at Royal Melbourne Institute of Technology (RMIT). Greenfly is an online streamlined LCA tool that is simple to use and can perform a rapid LCA of a product. The tool is based upon aggregated data from Sima Pro and LCA data gathered by RMIT in Australia, it takes the form of a simplified or streamlined LCA assessment. The tool is currently available online (November 2008) as an alpha (preview) version and is still under development but RMIT hope to launch it commercially. It has been advised by one of the designers that Greenfly it isn't suitable as yet for LCA outside of Australia due to the data sets being comprised mainly of Australian data (Acaroglu, 2009).

The tool gives 3D graphical results displaying the impacts for:

- Global Warming
- Water Use
- Energy demand
- Solid Waste
- Each of these graphs is then divided up into the four impact categories:
- Manufacturing
- Transport
- Use
- End of Life

(Centre for Design at RMIT, 2008)

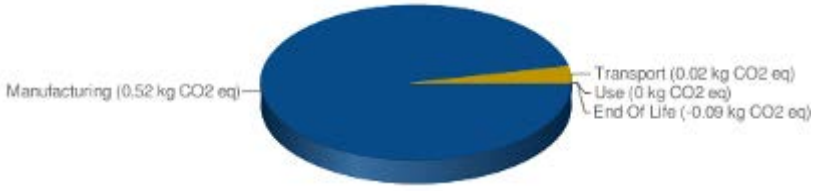


Figure 28 Global Warming of PET drinks bottle (Centre for Design at RMIT, 2008)

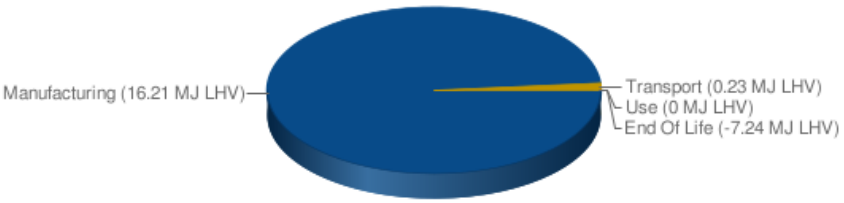


Figure 29 Energy Demand of PET drinks bottle (Centre for Design at RMIT, 2008)

Included in the results are generalised eco-design strategies (Centre for Design at RMIT, 2008) to suggest how the product can be improved, these are given in the form of a question and a list of prompts.

Sima Pro

Sima Pro is a commercially available full LCA tool developed by PRé Consultants. The software features extensive libraries containing environmental data for thousands of materials and processes ensuring a more accurate match then the simplified LCA packages. For instance electricity generation libraries contain environmental data for each country. This reflects the difference in each countries overall electricity generation make up. For instance a country which generates the majority of its electricity from coal will have a higher CO impact for any electricity usage than that a country, which generates the majority or its electricity from renewable sources or nuclear. This level of accuracy in the information is useful in when accuracy is required, reducing the requirement for assumptions that are made in the streamlined LCA assessments, however it makes the assessment process very time consuming.

Sima Pro considers the full lifecycle of the product or service, including separate consideration of the materials, energy, transport, processing, use and waste scenario and waste treatment. Typically in simpler LCA tools some of these separate impacts are grouped together for ease of use.

The network flow graph in figure 30 shows the level of the impact by the thickness of the red line, the thickest line giving a visual indication of where the greatest impact lies in each stage. The impact category can also be changed accordingly to show the impact in relation to environmental effects other than CO^2 emissions, specific impacts showing the effect on resource depletion, land use, ozone effects and toxicity amongst others can be calculated.

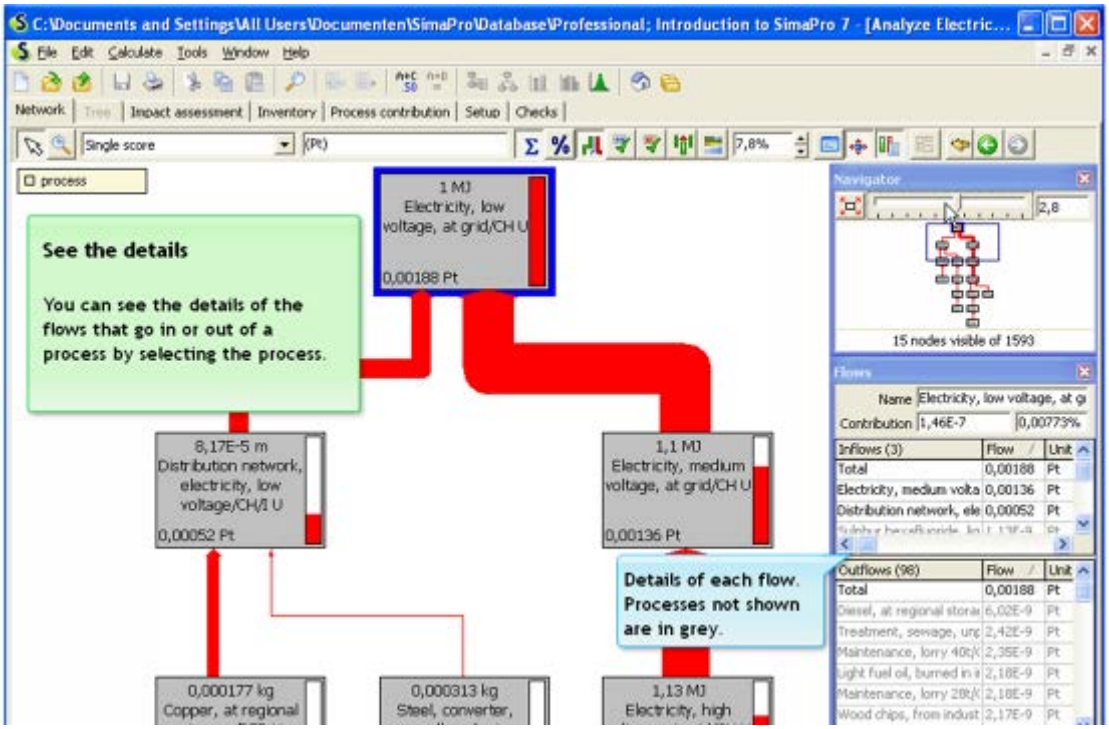


Figure 30 Network flow for the single score (PRé Consultants, 2009)

The complete lifecycle will be analysed and the areas of highest impact will be displayed, the data can then be used to inform redesign, check the effect of changes to the product or service or for auditing purposes. This tool is used within the department of design technology at Loughborough University in its undergraduate and postgraduate programmes.

Template based

Template based tools are paper based and used in the style of a priority setting and product improvement exercise (Tischner, 2001), facilitating a consideration of ecodesign. The structure of the tools relies on the user to identify the parameters for assessment or analysis, this could be seen as a limit to the accuracy of such an analysis. However each of these tools is designed to be able to use in a team based situation, ideally one that is multidisciplinary. Team working will ensure a more considered approach, with the benefit of many minds cancelling out errors that an lone individual may make (Denton, 1997). Each of these tools focuses upon the lifecycle considerations of the product, requiring the user to evaluate the products performance or identify key impacts at each stage. Such an approach however necessitates a need for prior knowledge of environmental impacts

and solutions. The paper based style to the tools allows for greater creativity and interaction than computer based solutions but removes the benefits of electronic storage or use of data into other applications.

Ecodesign web

The ecodesign web (Bhamra and Lofthouse, 2004) was adapted from the LiDS wheel (Brezet et al., 1997). The key differences are shorter descriptions to speed up the analysis, colour banding to indicate the level of the impacts, removal of production process considerations and the removal of numbers, so that the tool is truly qualitative. As it was found that the numbers were being used out of context as measurable values. These adaptations make the tool simpler, more user friendly and better suited to designers. This ecodesign web is used at Loughborough on both the undergraduate and postgraduate courses taught in the design and technology department.

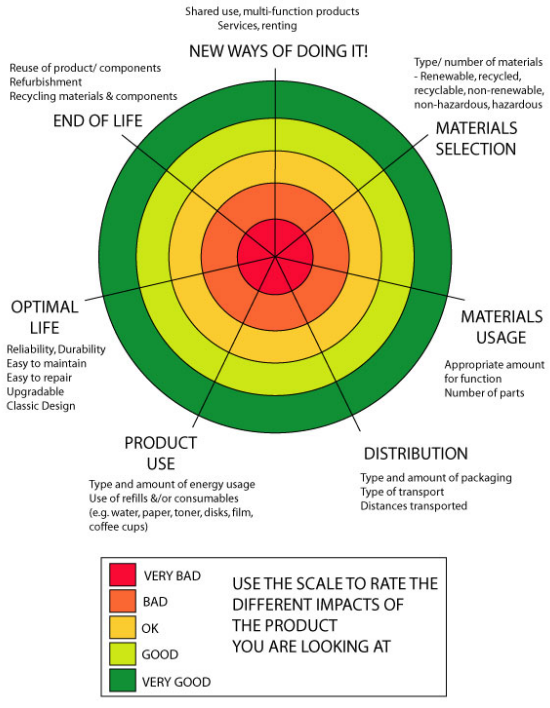


Figure 31 Ecodesign Web (Lofthouse, 2005)

The paper based tool see figure 31, considers seven ecodesign strategies in a graphical form, the first six strategies represent improvement options in the product life cycle and encourage the designer to consider how they can

improve on an existing product by considering improvements at each of the 6 stages of the life cycle. The seventh strategy encourages the designer to be revolutionary and to completely reconsider the product from a systems view point, encouraging the designer to consider the product as a service for example.

The tool is ideal for a redesign scenario where a designer can use one template to assess the existing design placing crosses in against each of the strategies highlighting how well or bad the products environmental impact is in each area. These crosses are then joined up and any sharp decline will indicate an area that needs attention in the products redesign. Indications on how to improve in each are given beside each strategy and solution and ideas can be creatively added around the sheet. The format allows for the improvements to be planned comparing the intended redesigned product to the original product in a relative benchmarking exercise. The ecodesign web cannot be used to determine the actual environmental impact of a product however, as it is a relative examination.

The tool is also useful for comparing products or design solutions and can be used when selecting concepts, because unlike LCA approaches it doesn't require large amounts of detail or a realised product because analysis can be conducted at a relative level. Ecodesign web can be in an individuals or groups and so can be used by students within their own design projects or in a group tutorial or studio setting.

MET Matrix

Is a paper based life cycle analysis tool. The matrix considers the product as a system with inputs and outputs defined by the three categories: Material cycle, Energy use and Toxic emissions. These categories are considered against the five life cycle phases used in many other approaches, production and supply of materials and components, in house production, distribution, utilisation and end-of-life system.

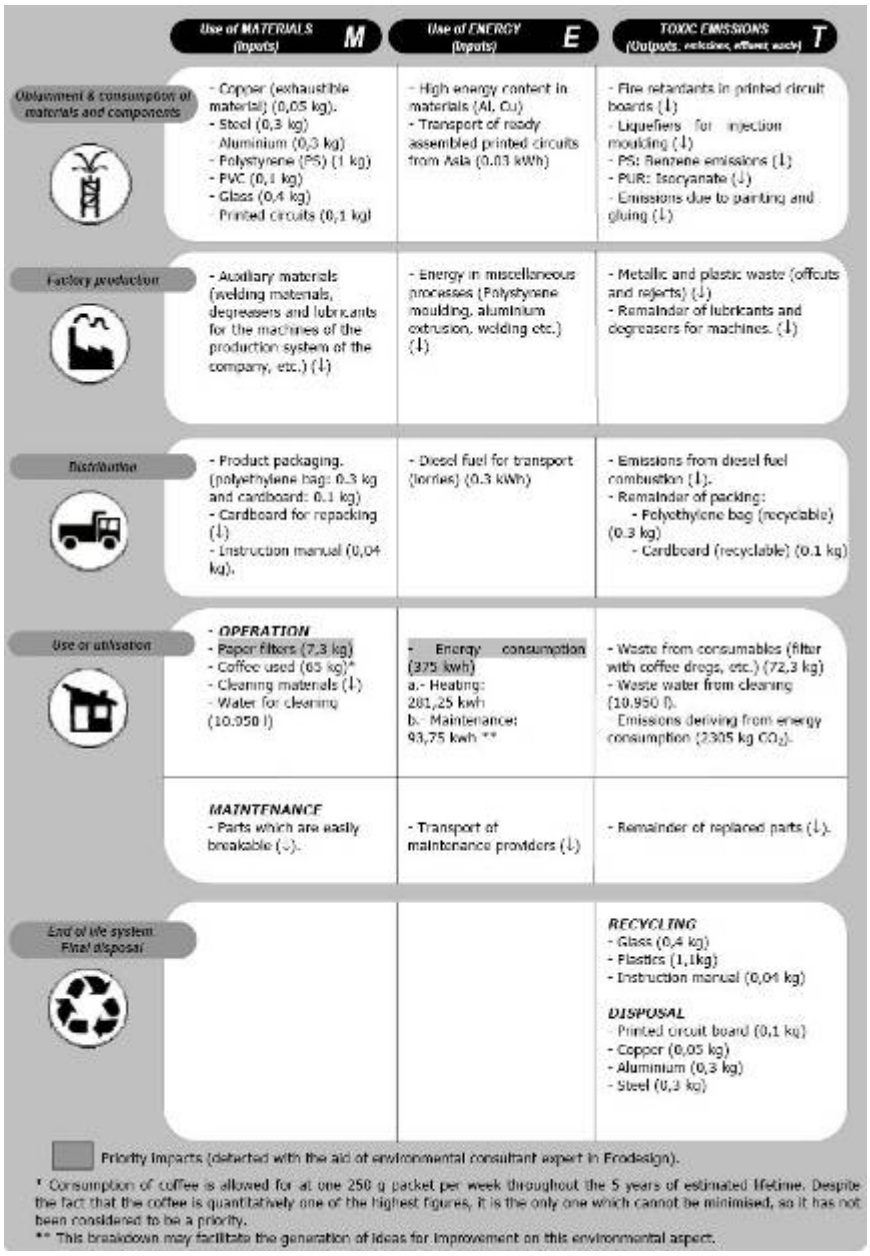


Figure 32 MET Matrix applied to a coffee machine (Brezet et al., 1997)

The MET Matrix (Brezet et al., 1997) is useful in a product redesign situation such as the Veromatic coffee maker (Visser, 1995) cited by (Brezet et al., 1997) and detailed above, in this example a multidisciplinary team has used the tool, analysing the physical product in order to plan improvements. It has been suggested that the MET matrix could be used in the concept and development phases of design (Delft, 2008), however this be unsuitable in the design of new products because of the depth of detail the MET matrix requires especially production data. However the tool could be to guide a

basic analysis of an existing product or competitor's products to indicate areas that need to be addressed in the design of a new product.

The analysis of the Veromatic coffee maker highlights the use phase shown in figure 33 as the stage with the highest impact due to the electricity consumption and the use of paper filters as shown below.

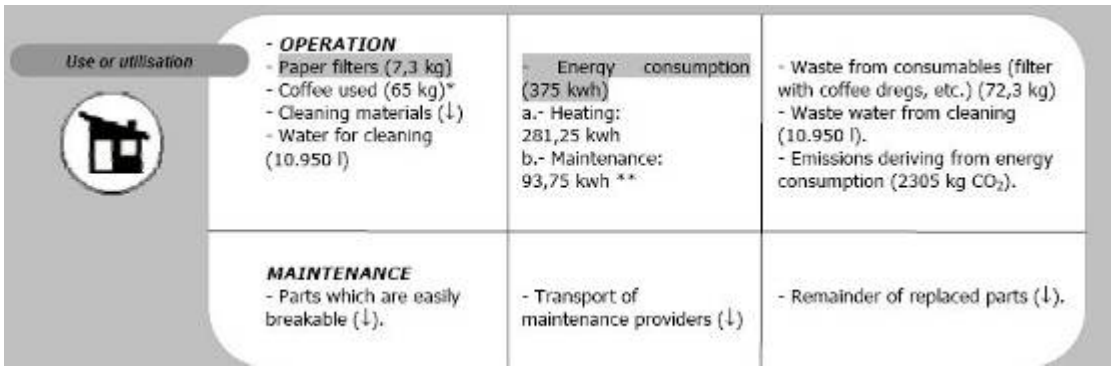


Figure 33 Coffee machine use phase impact (Brezet et al., 1997)

Guidelines and Checklists

Checklists and guidelines are useful throughout the design process and can guide designers in the implementation of sustainable design criteria in all areas concerning form, structure, materials, manufacture and use of the product. However checklists are often exhaustive and can be very long documents with many items of consideration (Brezet et al., 1997). In the development of the Ten Golden Rules (Luttropp and Lagerstedt, 2006) found that guidance in checklists can also be contradictory.

Ten Golden Rules

The ten golden rules is a streamlined theoretical checklist described as a tool and presented in a paper by (Luttropp and Lagerstedt, 2006). The author intended to produce a set of generic guidelines that could be customised by designers and applied to their own specific projects. The rules were intended to be a non-exhaustive guidance that would lead to consideration of the key factors in reducing the environmental impact of a product. The rules are a summary of guidelines given in company guidelines and handbooks and aren't intended as design tool in their own right but to be modified for different situations (Luttropp and Lagerstedt, 2006).

However due to their general nature some ‘rules’ could be seen to contradict others as described by the author, the rules also do not consider less traditional lines of enquiry such as a different non product way of fulfilling need like in some other non-qualitative tools.

Ten Golden rules

- Do not use toxic substances and utilize closed loops for necessary but toxic ones.
- Minimize energy and resource consumption in the production phase and transport through improved housekeeping.
- Use structural features and high quality materials to minimize weight .in products .if such choices do not interfere with necessary flexibility, impact strength or other functional priorities.
- Minimize energy and resource consumption in the usage phase, especially for products with the most significant aspects in the usage phase.
- Promote repair and upgrading, especially for system-dependent products. (e.g. cell phones, computers and CD players).
- Promote long life, especially for products with significant environmental aspects outside of the usage phase.
- Invest in better materials, surface treatments or structural arrangements to protect products from dirt, corrosion and wear, thereby ensuring reduced maintenance and longer product life.
- Prearrange upgrading, repair and recycling through access ability, labelling, modules, breaking points and manuals.
- Promote upgrading, repair and recycling by using few, simple, recycled, not blended materials and no alloys.
- Use as few joining elements as possible and use screws, adhesives, welding, snap fits, geometric locking, etc. according to the life cycle scenario. (Luttropp and Lagerstedt, 2006)

Information Inspiration

'Information/Inspiration' is a freely available web based resource, which (Lofthouse, 2005), which consists of two streams, one providing ecodesign information and the other providing product inspiration (Lofthouse, 2003). The information stream provides ecodesign information specifically directed at industrial designer's needs. It is divided into nine areas covering:

- Tools including the ecodesign web, design abacus and eco indicator.
- Materials information
- Guidance on End of Life routes
- Issues surrounding the use phase of products
- Optimising the life of a product
- New ways of designing a product such introducing the concept of product service systems.
- Distribution information
- Legislation
- Description of the different eco labels available and the qualifying factors.

The second strand provides inspiration for designers in the form of product case studies where the product features an approach that reduces its environmental impact. These case studies are chosen and presented with the aim of inspiring designers and motivating them to produce their own ideas (Bhamra and Lofthouse, 2007). The product examples are split into twelve categories including, electrical and electronic, consumer products, white goods, packaging, textiles, alternative energy, furniture, concepts, green design, interesting materials, systems and services and links to related websites.

This web based tool is used in conjunction with teaching to support pupils portfolio on both the undergraduate and postgraduate courses offered within the design and technology department at Loughborough University.

Sustainable design tools used in education

It has been suggested that there is there is a lack of tools developed specifically for sustainable design (Tischner, 2001) and this is particularly true of educational resources with only three resources being identified, of which only one is classified as a tool. In common with ecodesign tools no literature has been found on effectiveness or widespread use of any of the specific tools presented. Therefore a general description of the benefits of educational games has been given as an introduction to the two game based resources.

Design Abacus

The design abacus was originally tool developed by Shot in the dark (Shot in the Dark, 2007) and is used in an abridged form (Bhamra and Lofthouse, 2007) as shown in figure 34 on both the undergraduate and postgraduate courses in the department of design and technology at Loughborough University.

The design abacus is similar to the ecodesign web. It is a qualitative method that is paper based and is suitable for analysing a product at different stages of the design process. For example using an analysis of an existing product to outline targets for redesign in the product specification for the comparison of a number of solutions at the concept stage more detailed analysis at the detailed design stages

The design abacus however also considers wider aspects of design, rather than just the environmental impacts, including issues and requirements, which foster sustainable product design principles.

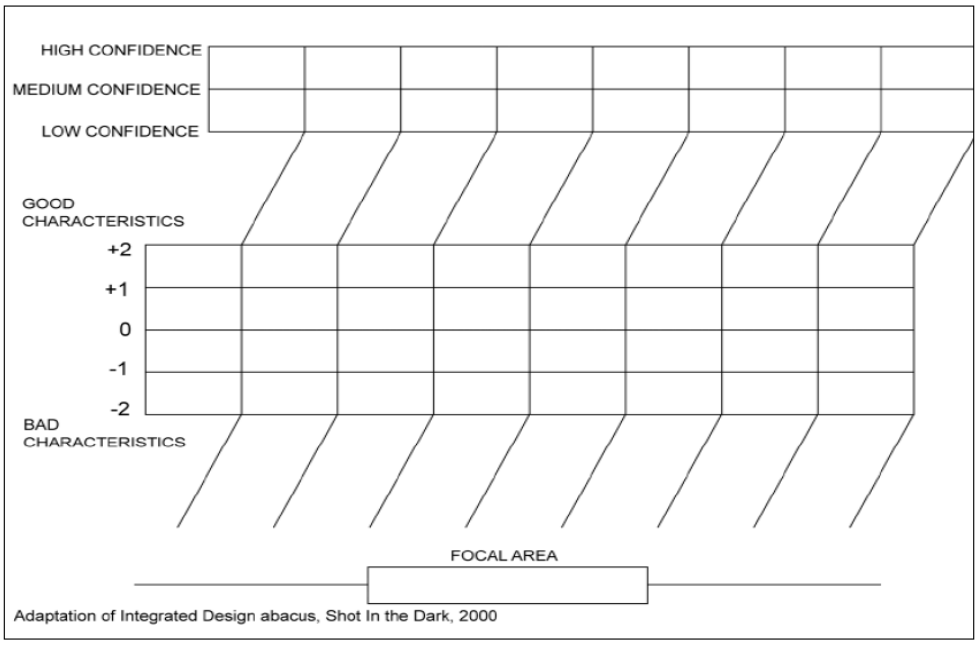


Figure 34 Design Abacus (Lofthouse, 2005)

The nature of the tool allows a variety of criteria to be assessed, such as: product longevity, materials, cost, usability, equality, community, energy. Each of these requirements is assessed on a separate sheet with the focus by being entered into the focal area box at the bottom of the template, good and bad characteristics are entered along the diagonal lines these for instance for a focal area of materials these may be recyclable versus non-recyclable, renewable versus non-renewable, high embodied energy versus low embodied energy, hazardous versus non-hazardous, lightweight versus heavyweight, long lasting versus short lived, biodegradable versus non-biodegradable.

APPENDIX C. ETHICAL ISSUES AT SEVEN RESEARCH STAGES

Ethical Issue	Addressing Ethical Issues
The purpose of the interview study should go beyond just knowledge acquisition and be considered in respect to the improvement of a human situation	The nature of the enquiry and the benefits of the outcome in respect to SPD education were made explicit to all interviewees through the initial email contact
Notes the importance of informed consent and confidentiality and well as the potential consequences of the study upon the interviewee.	Consent to interview each academic was gained via email prior conducting the interview and all respondents asked for permission to record the conversation. All academics interviewed were made aware that the research is part of a PhD study and therefore will be published in the thesis and interim paper publications. However consideration was taken in writing up the transcripts with personal comments being removed or rephrased if deemed to be damaging to another person or the career of the interviewee. Similarly language that was deemed to be inappropriate in a professional context was removed from the transcripts or replaced for an equivalent term. A number of the academics have published papers and or books in the field and so in many cases any personal opinions in the interview only echoed stances or opinions they are known to hold.
The consequences of the interview such as stress from the context and changes in an understanding of one's self.	The academics that were interviewed were extremely confident and capable in their fields and so it was unlikely that the interviews would cause them stress or even too change any personally held views although many of the interviews did lead to interesting discussions upon personal stances. Student interviews may have led to changes in understanding however it was made clear to all students that their participation would not affect any past or future grading.
Confidentially and original meaning needs to be protected in the transcription	All interviewees were sent copies of the transcripts once finalised for checking, it is expected that they would highlight any inaccuracies and material that is sensitive.
How deeply the interviews can be analysed and whether the interviewee should have	The transcripts are subjected to coding and clustering to identify common meanings, a recognised analysis method. On rare cases

a say in the interpretation.	occasions actual quotes may be used where they illustrate a finding particularly. To include the interviewee's at every stage would be very time consuming for the busy academics involved so they will not be involved in the analysis interpretation.
How critically the interviewees can be question to ensure verified findings.	Interviewees were asked similar questions to each other however the purpose of the interviewees were to elicit information including their personal views. This is recognised in the study and therefore verification is not required as the analysis of each stage brings together either the personal views or experiences of a number of academics or those of students.
Confidentiality relating to reporting.	All of the academics are also aware that this is part of a PhD study and therefore the results will be published. Where applicable ideas already aired from other lectures were aired during the course of the interviews to elicit discussion and debate. However all of the academics are known and respected within the field and many are aware of each other, through published papers and or books in the field and so in many cases any personal opinions in the interview only echoed stances or opinions they are known to hold. Student names will not be used in any reporting.

APPENDIX D. ADDRESSING THE DISADVANTAGES OF THE QUESTIONNAIRE FORMAT

Disadvantages of Questionnaires taken from (Gillham, 2000:8)	How these are addressed in the survey design
'Problems of data quality (completeness and accuracy)'	Respondents of incomplete surveys were emailed to ask them to complete them. Incomplete surveys were not counted in the analysis
'Typically low response rate unless sample 'captive' Problems of motivating respondents'	The questionnaires were aimed at an interested audience all being academics in the field of study, individual named invitation emails were sent out to all the academics, which ensured a very high response rate. The questionnaire intended to motivate the respondents by the relevance of the survey to their teaching and by disclosing the results.
'The need for brevity and relatively simple questions'	Questions were kept as short as possible with only 15 in total. The questionnaire was piloted to pick up any ambiguities and changed accordingly. The sample also represented highly educated individuals, and therefore the need to keep questions simple was irrelevant.
'Misunderstandings cannot be corrected'	The questionnaire was piloted amongst academics at the host institution and the nature of the online questionnaire enable the researcher to review incomplete replies and email the participants to address any problems or misunderstandings encountered.
'Assumes respondents have answers available in an organised fashion'	The design of the questionnaire enabled respondents to save their responses online and return at a later date so that the information could be obtained if necessary this was particularly applicable to a question regarding the curriculum.
'Lack of control over ordering and answering of questions'	The online questionnaire provider offered a number of control options in the questionnaire such as mandatory questions that required completion before the respondent could move onto the next question and these were used accordingly on a number of vital questions. The online format means that the questionnaire is answered in a given order that cannot be altered by the respondent.
'Questionnaire wording can have a major effect on answers'	This was understood before the outset, which is why open-ended questions were used for opinion based questions with large text boxes and no prompts. Closed questions were used when factual answers were required.
'Respondent literacy	As already stated the sample represents highly

problems’	educated individuals within the field of higher education, so the terminology used would have been familiar to the respondents
‘People talk more easily than they write’	Plans had already been established to interview the most interesting questionnaire respondents to gain greater detail in a face-to-face interview setting.
‘Impossible to check honesty or seriousness of answers’	This is a particularly difficult are to address and the questionnaire will have a small inherent error identified by the researcher due to personal pride and wanting to place their institutions in a good light. However this source of error would be evident in other research methods such as interviews and is not specific to questionnaires. However accuracy could be improved by contacting another academic in the same department to confirm specific facts or claims.
‘Respondent uncertainty as to what happens to the data’	The aims of the research and how it was intended to be used was made explicit in the questionnaire introduction page, which also contained a link to the researcher’s webpage. Respondents were given the option at the end of the questionnaire to give their contact details so that they can receive the outcomes of the study, a paper outlining the findings was sent to all such respondents once published 9 months later.

APPENDIX E. QUESTIONNAIRE INVITE EMAIL

Dear (Prefix) *Name*,

I am part of the Sustainable Design Research Group at Loughborough University and I would like to invite you to take part in an online survey, reviewing sustainable design teaching on product and industrial design courses in British universities http://www.survey.lboro.ac.uk/spde/. The survey should take less than 10 minutes to complete, and as an academic identified as teaching product or industrial design your input and comments in this survey would be greatly appreciated.

Many thanks,

Matthew Watkins
Research Student
Department of Design and Technology
Loughborough University
Loughborough,
UK
M.A.Watkins@lboro.ac.uk
http://www-staff.lboro.ac.uk/~cdmaw/index.htm
07838245674

APPENDIX F. ONLINE QUESTIONNAIRE CONTENT

A review of sustainability in industrial and product design education within British universities

This survey is part of a doctoral research project being conducted at Loughborough University. The aim of this survey is to review the state of sustainable design teaching upon undergraduate and postgraduate industrial and product design courses within the UK. The results will be used to inform further research into the effective teaching of sustainable product design, potentially leading to the production of resources to aid teaching within the UK.

The survey contains 16 questions and should take approximately 10 minutes

Any additional questions regarding the content can be directed to:
Matthew Watkins, Research Student, Sustainable Design Research Group, Department of Design and Technology, Loughborough University
M.A.Watkins@lboro.ac.uk
Further information can be found at the following webpage http://www-staff.lboro.ac.uk/~cdmaw/index.htm

1. Name (optional)

2. University

3. Position (if applicable)

4. How would you define sustainable design within the context of industrial and product design education? (open question)

5. Please indicate which of the following requirements are included within the teaching of industrial or product design education at your institution.

Design for the aged	
Design for behaviour change	
Design against crime	
Design for disassembly	
Design for the environment	
Design for manufacture/assembly	
Ecodesign	
Emotional design	
Emotionally durable design	
Ethics of design	
Inclusive design	
Product service systems	
Responsible design	
Sustainable design	
Systems design	
Universal design	
(others please specify below)	

6. Considering the same requirements, which do you consider ***could be, should be or is*** incorporated within your courses into the context of sustainable product design:

Topic	Could	Should	Is	Further comments
Design for the aged				
Design for behaviour change				
Design against crime				
Design for disassembly				
Design for the environment				
Design for manufacture/assembly				
Ecodesign				
Emotional design				
Emotionally durable design				
Ethics of design				
Inclusive design				
Product service systems				
Responsible design				
Sustainable design				
Systems design				
Universal design				
(others please specify below)				

7. If you teach sustainable design on a product or industrial design course please select which year and level the content is taught.

Year	First	Second	Third
Undergraduate			
Postgraduate			

8. Please also indicate on which course type sustainable design content is taught.

BA	Product Design	
BA	Product and Furniture Design	
BA	Industrial Design	
BSc	Product Design	
BSc	Industrial Design	
BSc	Industrial Product Design	
	(other please specify below)	

9. How is the sustainable design content included in the course content.
   - Though generic courses outside of the design department
   - Though individual lectures, unrelated to design project work
   - Through a lecture series, unrelated to design project work
   - Through a single design project based module specifically focussing on sustainable design module.
   - Discreetly throughout all design projects.

10. How would you describe your personal knowledge of sustainable design:
    - That of a specialist
    - Have a full working knowledge
    - Familiar and can grasp the basic concepts
    - Limited understanding
    - No understanding

11. How would you describe your personal educational needs regarding sustainable design:
    - Would appreciate dedicated training

- Would find detailed resources and guidance helpful
- Require guidance on the consideration of social and ethical issues in design
- Could do with a refresher of the basic concepts
- No needs
- Please add any further comments below…….

12. Do you or your department collaborate with other institutions in the teaching of sustainable, if so please state which and how.

…….

13. Do you network with other academics regularly through, email groups such as O2 or JISC, or networks such as the Sustainable design network. Please state which below:

Design Research Society	
JISC Mail groups	
PHD-DESIGN Index	
SUSDESIGNTEACH	
eco-innovation_network@yahoogroups.com	
O2 mailing list	
Sustainable Design Network	
(other please specify below)	

14. Given the opportunity which of the following methods do you consider to be preferable for the teaching of sustainable design:
    - A specialist optional module
    - As a compulsory module
    - Integrated throughout the core design curriculum as an aspect of good design.

15. Thank you for participating in this survey if wish to receive the dissemination of the results or would be interested in further involvement in student trials, please give your details and select the correct box below.

…….

APPENDIX G. INTERVIEW QUESTIONS SAMPLE

Interview Script for (PD) – Plymouth University

Course material

I understand you teach on both the BA and MA courses within the department and you particular specialism is design culture and so most of my questions will be regarding how you teach sustainability through that.

1. I recognised that the BA courses have a core module each year in Design culture and context. Can you tell me more about these particular modules?

2. How is the material do you delivered in these modules? i.e. lecture, tutorial, studio, e-learning etc.

3. I recognised from the Masters module description that social, cultural and sustainability considerations are considered in all the MA's offered through the Design Thinking module. Could you tell me more about this module?

4. How is the material do you delivered in these modules? i.e. lecture, tutorial, studio, e-learning etc.

5. In the questionnaire you clarified the following as being incorporated in the teaching of sustainable design at Plymouth. Could you explain how the format or example of teaching for a few of these?

Topic	C	Is	Lecture	Tutorial	Studio
Design for the aged		Y			
Design for behaviour change		Y			
Design against crime		Y			
Design for disassembly		Y			
Design for the environment		Y			
Design for manufacture/assembly		Y			
Ecodesign		Y			
Emotional design		Y			
Emotionally durable design		Y			

Ethics of design		Y			
Inclusive design		Y			
Product service systems		Y			
Responsible design		Y			
Sustainable design		Y			
Systems design		Y			
Universal design					

Course Structure

6. In your teaching how do students demonstrate their learning of sustainable design? Is it through the design projects or essays/assignments?

7. Is this multidisciplinary teaching offered i.e. Do students have the opportunity to take a module or lecture in another department/subject. i.e. sciences, engineering, sociology etc.

8. Do you use any tools/resources in conjunction with the teaching or learning? i.e. ecodesign tools/websites/games – flow maker/prompts IDEO cards etc.

9. What criteria is used to assess sustainability in students projects/reports is it set criteria or largely objective?

10. Is the assessment primarily conducted by the teaching staff or are there opportunities for peer assessment either informally in tutorials/studio practise or as part of the formal end of module assessment?

11. What do you consider to be the benefits and pitfalls of peer assessment in sustainable design?

12. Have you encountered any barriers in teaching sustainability within the product design curriculum? i.e. institutional/course structure.

13. Similarly have you found any barriers to students learning and or application of sustainable design considerations?

14. What is the most effective method to engaging students in sustainable design?

15. Do you approach sustainability in product design from an applied view point using tools and applied theory (how sustainability can relate to design) OR approach sustainability from a philosophical and holistic viewpoint that is more open to interpretation (how design relates to sustainability)?

16. How does the above question manifest itself in the students experience are the design briefs and outcomes fixed or open or a mixture of the two?

17. What do you perceive as the respective benefits and disadvantages of the applied and holistic methods?

18. Do the students partake in team based projects in sustainable design? If so how is this structured and what do you think the benefits and pitfalls are/would be?

19. Generally speaking what are the students attitudes towards sustainability and how important do they consider it in relation to the rest of the curriculum?

20. What do you think drives or informs the student's attitudes?

Collaboration

21. In the questionnaire, when asked about external collaborations you stated that you have some connections to Kingston, Brighton and Falmouth universities. Could you expand further upon the nature of these collaborations?

22. Does the Centre for Sustainable Futures run a research group and is it this that predominantly supports the teaching staff's training needs within sustainable design or the visiting speakers such as Alistair Fuad Luke?

23. At Loughborough design students find the Ecodesign Web to be a useful tool for helping them to quickly start thinking about the sort of ecodesign issues which are relevant to them. However no similar guidance currently exists for the social aspects of sustainability. My research project intends to address this and I curious as to what sorts of social issues you think designers should be considering.

APPENDIX H. CODED INTERVIEW TRANSCRIPT SAMPLE

Subject: Interview with A7 **Location:** Lancaster University			
Name	Conversation	Time to:	Codes
Me	Is it alright if I get you to recap what was said a minute ago? So there's two masters courses	00:21	Cor-MA
A7	Okay yeah, there's two masters courses one called MA Design management and policy and another called MA Sustainability Innovation and Design and students from both courses do the module, which you just attended which is Imagination 411 Design Sustainability and Contemporary Issues and there were also some PhD students in there as well.	00:51	Cor-MA Mod-Sus &Con-Iss
Me	Yes that was Steve was it?	00:57	
A7	Steve is on the PhD Highwire course which is an interdisciplinary PhD, which is a new kind of PhD with business and industry and it is a joint PhD among Imagination which is design, Infolab which is computing and the management school.	01:25	
Me	Okay		
A7	So you get courses from all three doing a first year MRes course and in that MRes course they take modules in design innovation and design, innovation and business management, innovation and computing and from that first year they then formulate what their PhD topic is going to be based upon a fuller understanding of those three areas because it has got to be interdisciplinary and with industry and so then they start their three year PhD after they have completed their major project in their MRes. But there are also a couple of PhD students in the course from just Imagination, Imagination straight PhD's and they are recommended different courses to take to get them up to speed.	02:25	
Me	Yeah that is a good idea, yeah. Umm reading through the module outline for the module run this morning Design Sustainability and Contemporary Issues. It was quite interesting actually I was quite excited by the class discussion about Bauhaus and modernism I thought I want to be there for that, that's sounds great I like that. But in regards to the lecture style would I be right in surmising that the teaching is more of an inspirational and example based rather than a directed style?	02:58	
A7	Well there's a number of different educational styles in the course I start of by giving an introductory lecture basically introducing the students to what the course is about the ways of looking at design and sustainability and contemporary issues and the notion of design critique and critique and review within design and looking at design topics how, what critique means so that we can look at the nature of activities in terms of critical review be it	06:10	Lect-Des/Sus/ Con-Iss

	sustainability or design or the philosophy of design or the philosophy in which design is being carried out or contemporary issues various contemporary issues. And in that first lecture I give them class assignments but in order to give them some lead time so they can start doing some research then the following classes I have a lecture, a formal lecture on the industrial revolution, which basically goes from about 1740 to the beginning of the 20th century to basically explain how we got to where we are in terms of technological society mass production, consumerism and the start of design. With Raymond Lowy and all those early designers and the development of mass produced consumer goods in the last decade and of the 19th and the first decade of the 20th century. So it basically goes from rural cottage industries in the early 1700's through the British stage of the industrial revolution into the US stage of the industrial revolution and the development of scientific labs and research laboratories then the next lecture following that is a chapter from my book called sustainability the evolution of a contemporary myth. Which looks at the changes of the late 19th century up until the 21st Century so mainly over the course of the 20th century, which led to our current understandings of sustainability both in terms of environmental awareness and dealing with environmental issues and social changes so the civil rights movement, the gay rights movement, feminism and how those impacted on our understandings of social equity, social justice, which is one of the arms of sustainability the triple bottom line so there's economic, social equity and justice and environmental issues I introduce a further a forth one a quadruple bottom line where the forth element is personal meaning.		Lec-Des-Phil Ass-Res Lect-Hist Lect/ Sus-His Lect/ Sus-Soc-His Soc/Equ Soc/Just Sus-3BL Env-Sus Sus-4BL Per-Mean
Me	Ahh I'm glad you said that I'm just going to. I was just reading something this morning actually it was the Aran Stibbe book Sustainable Literacy and some body actually quoted a reference which I think was Hanson (2001) *(actually Hawkes 2001)* but I'll have to check that. But they talked about the forth element being cultural do you, would you agree its similar.	06:32	Soc-Cult?
A7	Yeah I know I talk about that I don't think it should be cultural in fact I am just having a paper being published in Design Issues where I talk about the quadruple bottom line and I say that certain some people have suggested culture as the fourth element some people have suggested governance, some people have suggested a combination of culture and ethics and some people have suggested spirituality and basically I think governance, culture and ethics can be included in the triple bottom line, spirituality is getting closer because its more personal. The missing aspect in my view of the triple bottom line is that the economic and social or its all mixed up social economic we could say social wellbeing was partly economic wellbeing	09:44	Soc-Cult-Non Soc-Cult-Non Soc-Gov-Non 3BL=Cont/Cult/ Ethics Spirit

	and social wellbeing are related of course and that's related to social justice and social equity. But it deals with the social and communal aspects of what it is to be a human being that we live as a society we are gregarious creatures living together. So the triple bottom line deals with that aspect of our humanity quite well and from the societal point of view and the communal point of view, economic well being is important social justice and equity is important and of course looking after the national environment, which is important because you want to live in a healthy environment so they all have social ramifications what it doesn't deal with and what it doesn't actually recognise is that we are not just social creatures were also meaning seeking creatures individuals we are also individuals and those individuals are meaning seeking and spirituality gets close to that. The problem with the term spirituality in my view is that it immediately invokes notions of religion, the soul and aspects which some people particularly in western society, particularly in European western society would find my difficult. Personally I don't have a problem with it but recognising that we live in a secularised society these days and there is branches of almost fundamentalist atheism. To talk about spirituality may not gel well with certain people so I've just called it personal meaning, which can include spirituality, but it can also include atheistic viewpoints and secularised viewpoints, humanism and all the rest of it. Which doesn't necessarily invoke the same kind of religious connotations that the term spirituality tends to do.		Soc-Com Per-Mean Spirit Per-Mean
A7	So anyway I talk about all those things in that lecture and then the students start presenting the first set of their own personal topics and its two sets of assigned topics and then I work with the students over the course of the module to develop topics of their own that they want to particularly look into with a view to starting to think about their major project at the end of their masters or their thesis if they are doing a PhD. To start to get to grips with some of the issues to do some of the reading, find out who the main writers are in that area. So its an opportunity for them to really explore interests which are personal to them but also it falls within the general intentions of the course, which mean contemporary issues anything will do so its pretty open from that point of view but the first set of set topics are related to sustainability so they are things like environmental footprint, triple bottom line, cradle to cradle, factor 10 or whatever a lot of the typical issues that you hear about when you get into the literature of sustainability and I ask them to go off do some literature surveying search on the web in the library get articles and write a 1-2 page summary referenced where they basically absorb that data and succinctly summarise it and then do a 10-15 minute presentation back to the class and then lead a discussion upon that topic so that we can	11:42	Asm-Pres Asm-Res

	talk around it.		Asm-Pres Asm-Deb
Me	So its very much the independent and peer learning?	11:45	Peer-Indie
A7	Yeah well so there is some formal lectures, there's some inquiry based learning, which is elf motivated they have to go to the library and search out investigate the topic that they are given and then present it back to the class and I think that is a very useful way for them to learn about a topic rather than just sitting listening, which I don't find is very useful for anything at all really introducing some general concepts but so much doesn't get absorbed but when they have to go off and find out about it themselves it's a much better way of learning.	12:20	Lec-For Res-Inq
A7	So there is those and then the second set of set topics focus on some of the implications of those issues. For communities, societies, companies, personal behaviours, government decisions and policy and so they have to look up and start looking at information where issues of sustainability are making a difference and what are the responses to sustainable issues in local government and they often have to search about that, or within corporations, or within small and medium size enterprises how people are actually responding to these challenges to sustainability so it makes those issues more current and they start to get into are they working do they have any value what's working so for example things like the natural step has been adopted by IKEA and the Body shop often they have to go off and investigate that and good examples as well like Peter Senge's book the necessary revolution and gives examples about Nike and Xerox and companies that are actually trying to make a difference. Interspersed with those then are some other things this term there were four guest lecturers two by PhD students who are in Imagination or associated with Imagination, looking at the projects they were doing and the research they are doing and how they are doing it and two guest lecturers by design practitioners. We had one lecturer by Steve Johnson from Preston his creative director for a company called the HUB in Preston a number of years ago. Doing marketing brochures and company annual reports stuff like that. But he has transformed the company over the last few years with his business partner from a graphic design company and doing those kind of things to a social marketing company and so almost exclusively what the do now is what you call social marketing clients for that kind of think are people like local governments, the NHS, public sector, dealing with issues like addressing teenage pregnancy, encouraging people to give up smoking, appropriate use of and awareness about drugs or medication or the swine flu or whatever the issue is as part of a larger government policy to address a particular issue so he came in and talked which was very useful and the second guest speaker was last week whose David	17:06	Soc-Com Per-Beh Sus-Pol Sus-Ind Loc-Gov Sus-Ind Sus-Ind Let-Ind Soc-Mar

	Constantine from Motivation UK I don't know if you know Dave Constantine I was at the RCA with him and he founded Motivation it's a charitable trust they do wheelchair design for developing countries and his worked in about 30 countries all over the world not only designing wheelchairs in developing countries out of local materials but also provides training programmes, cultural programmes about social acceptance of people who are paralysed, because in many countries that's regarded as a kind of stigma and people are kept at home behind closed doors because there is a social stigma associated with it so he gave a very interesting public lecture last week which the students came to in the evening and then he came to the class the next day.		Des-Inc Ind-Pres
A7	In addition to the student topics there are also reading classes, reading topics classes where I encourage the students to understand the nature of critique and formulating their own views and reasoned arguments about the topics they are considering so there is a series or readings one is about criticism and elitism, another is about the Bauhaus and Modernism and another is on perspectives in design and for example criticism and elitism has got a series of readings one is by the novelist Jeanette Winterson from a nonfiction book, which she wrote a few years ago called Art Objects and she talks about objects then there is an essay or an extract from John Carries book what good are the Arts that absolutely slates Jeanette Winterson's view from her book art objects and gives a completely different perspective on the same topic and criticises Jeanette Winterson strongly for her view and then there is a piece from the Times by Jeanette Winterson criticising John Carrie.		Crit-Read
Me	So that's the response kind of thing?	18:51	
A7	Yeah, so there is that kind of back and forth and the students said when they read it that they completely accepted Jeanette Winterson's view and then they read John Carrie's view and completely accepted that and then they read Jeanette Winterson's and accepted that and so they had to try and figure out what they thought and why they thought what they thought and then with the Bauhaus one there is a piece by Gropius, Walter Gropius about his intentions for the Bauhaus what he was aiming to do. Then there is a piece by Tom Wolfe from his book from Bauhaus to our house, which criticises the Bauhaus and then there is a piece by Robert Hughes who was the art critique for Time magazine reviewing Tom Wolfe's book from Bauhaus to our house saying why he is wrong and it is this back and forth. So that is meant to generate discussion in the class. They read that and then they come to class and discuss what they think and why they think what they think.	19:57	Sem-Deb
Me	Do they maybe say what they think before hand as well? Because obviously I'm a big Bauhaus fan so I would probably go oh Tom Wolfe but you know, afterwards I've not read his bit but it could be quite interesting to see if they	20:00	

	have changed their mind.		
A7	Laughs… Well they both. A lot of what I say about the nature of criticism is that you have to declare really where you are coming from and in what way you are criticising and commenting on things. Because you could criticise my laptop computer you could critically review a laptop computer from all sorts of perspectives from aesthetics, from green issues, from functionality, ease of use, cost, it depends and we could be talking at cross purposes because you could be criticising it from the terms of functionality and I could be thinking about it in terms of green issues and there wouldn't be a meeting of minds. Often when biases and perspectives are declared in advance then it sort of clarifies the situation. So that is why we do that and then the last part of the course is student topics as you saw today where they develop and we have some tutorials so there is a couple of what I call clinics in the class where there is individual meetings with students where we talk about the development of their topic. So you can see there is a whole variety of ways of learning in the class there is formal lectures, there's inquiry based learning where the students do library research and then present, so they are learning how to summarise. Because I deliberately make them one page summaries of very complex topics, where they really have to get to the core of the issues and state it very clearly and reference that so they learn how to do proper referencing as well and then they have to present it to the class so they have to think about how they are going to present it and present it succinctly with illustrated slides and then there is class discussions so they do readings and there is that kind of learning and then there's guest lecturers where they actually have the chance to hear professionals and PhD students talking about their topics and get insights into that so there is a whole variety and there is the one on one clinic meetings which are more like seminars where we work out just one on one what their topics could be.	22:43	Tut Peer-Sem-Deb
Me	Brilliant so I'll skip ahead because it applies, when they do presentations and have discussions afterwards is there any peer assessment at all in the course where they are assessing each other either informally or formally	23:08	Peer-Asm?
A7	Informally there's peer assessment informal peer assessment I would say through the discussion after the topic not that there was much today because we overran but they present their topics to the class and then lead a discussion on it normally with the special topics set topics there is two or maybe three presentations per class and they are an hour and a half class but we generally overrun to two hours which isn't good practise but we do nobody seems to mind. So there is a chance for peer to peer discussion were they can question each other. The problem is that they tend to be rather gentle on each other because they know they are going to have to get up and talk as well. But I want them to talk about it in terms of not just negative	24:28	Inf-Peer-Asm Deb-Asm Peer-Deb Asm-Crit

	giving criticism but proper critique where you sort of analyse it and analyse the arguments and raise questions that weren't addressed or weren't addressed well. So there is no peer to peer formal critique.		Non-For-Peer-Asm
Me	Going back to the critique think really because I suppose because probably in that way you are teaching them how to respond to external information about sustainability, environment and so on and so forth. I suppose at the start of course because its. What are the students attitudes to sustainability at the start of the course and what do you think informs their opinions.	25:02	Stud-Att?
A7	Well you know the reason I named it design sustainability and contemporary issues. When I was in Canada I used to run a course on design in sustainability and another course on design criticism and I kind of combined the two because I wasn't very sure how interested students would be in sustainability so I wanted to keep the course open for students who weren't particularly interested in social sustainability their interest lay somewhere else. Because I think it is important at the masters level for students to pursue areas that they are really interested in and passionate about rather than thinking they have got to go through this and their not really that interested.	25:46	
Me	It's a core module isn't it so?		
A7	Yeah……but what I found is that they are very interested in sustainability and they are very interested in these issues. Maybe they come in thinking its just about environment that's the usual mistake if you like that is it's just about environmental issues sustainability equals green but that's why I give the first couple of lectures that I do because I want to show that its much broader than that but even so we saw in one of the presentations this morning that there is still confusion because one of the students was talking about environmental sustainability, economic sustainability and as you heard me point out that's using that kind of language immediately confuses the issue so its getting those kind of clarifications but at the same time the same student did a very good job I thought in clarifying some of these terms and a lot of that has been a big part of both the set topics and the discussions because when students use terms like corporate social responsibility, like sustainability, like sustainable development what do they mean and are they clear about what they mean and of course often they're not and that's why I get a lot of them to go off to the library and research it so they come back and share it with the class so that they get more clarity and the students in the class get more clarity and sometimes I even get more clarity 'cause it's been quite useful they go off and find the latest readings and stuff often which I don't have time to do so it's useful from that point of view as well.	27:44	Stud-Att+ve Env-Att Non-Sep-Iss
Me	I think on that I have kind of noticed in my research so far just from the initial questionnaire and from speaking to experts like yourself in the field. There seems to be two	29:00	

	approaches to teaching sustainability I think it depends on the nature of especially the masters course at bachelors' it is more applied because it has to be but even on masters courses it depends very much on which disciplines are considered obviously yours is an MA in Design so including there was architecture there today and interior design as well and I have noticed form instance Kingston Anne Chick the way she runs her course is very holistic it looks at all the big issues you know it kind of looks at NGO's and how stuff can be incorporated in business and its very wide and that's MA Design, where as at Loughborough the masters is very applied they use tools such as ecodesign wheel, Eco Indicator, to look at environmental issues and sort of look at inclusive design aspects and its very much an applied way of how product and industrial designers can go and use it in practise. Where would you put your course.		MA-Des Cor-Hol? Cor-App?
A7	Well its definitely not here is a tool go use it, its definitely not the eco Indicator approach I personally have big issues with that kind of approach because I don't think you can put sustainability in a computer program.	29:15	Non-Tool
Me	No I tried that that was my first idea for my PhD and I decided to ditch that idea.	29:21	
A7	But I don't think you can include the whole world in it either and I think while design for developing countries is a big part of social responsibility, social equity and so on. I have always steered clear of sustainable development being closely associated with appropriate technology for developing countries and design for developing countries. Although we had a lecture this time by David Constantine but there was a UN they have closed it now but a few years ago there was a UN design for sustainability section and it was all based on design in developing countries things like pre things like the intermediate technology group and practical action it was run by Yorick Benjamin you know Yorick Benjamin.	30:29	Non-Sus-Dev
Me	Yeah I have come across his name	30:31	
A7	His down in Falmouth now in University of South West but a lot of it was about projects in developing countries like the bamboo bicycle and making stuff out of muscle shells and things the kind of thing that practical action does and the reason I haven't focussed on that in my own work is because I think the problem really lies in developed countries not in developing countries. Developing countries has a whole series of other issues but the real polluters and the real consumers are not those people and what we seem to be teaching them is that they should be like us in terms of their consumer habits and you know things like a computer for every child a laptop for every child a $50 laptop or whatever, while it might have some educational benefits potentially has some negative effects as well. So I think we have to be very weary of those kinds of initiatives.	31:43	Sus-Dev-West
Me	I think the developed world very much leads by example and so they look to us as aspiration, so we want to be like them.		

A7	Yes that right so I have always concentrated my own efforts on looking at the economically developed countries and how we can address the issues within that and really what sustainable thinking in my own research. What sustainability means, what it implies for the way we do product design and development. Because I come from an industrial design background and looking at it from a academic perspective and very much a research through design perspective and when we are in the new building we will be running what we call imagination labs, which are studio based modules where we will be looking at these issues in more of a design studio at the moment we don't have design studios so we can't do it, but we'll do that when we are in the new building. So there will be more of a practical hands on approach then in terms of conceptual design. But the big part of design for sustainability, product design for sustainability is in my view localisation and how we bring that into our notions of product design, which are mass produced for global markets today so the two don't gel	33:23	Sus-Dev-West Studio-Des Soc-Loc
Me	So keeping back to your personal work on design redux	33:30	
A7	So what are the implications so where does localisation come in and how does it relate to Manzini's work creative communities and product service systems and those kinds of relationships and the provision of services at a local level to partly manufacture but also upgrade, maintain, repair, remanufacture products and how does that effect our notions of products and aesthetics, consumerism and what a product is and then that informs some of the topics students are looking at. For example one of the students looked at the steady state economy product by Herman Daly, which has tremendous implications. It doesn't have much chance of ever being taken up but in terms of an academic study, I mean its got a lot of supporters as well. But the notion of a steady state economy in terms with its relationship with sustainability is very important. But where its real value lies is what it implies for how we do our business, how we look at our activities I think, and that is the kind of thing I do through product design looking at what the implications of doing things at a more local level. For the creation and maintenance and remanufacture of our objects has for the nature of material culture and that comes through in my lectures to students. We do another course called design thinking and research methods one of the lectures I gave this year in that course, was a lecture of research through design as a research method. But it was very much a personal case study if you like it was a discussion about the objects I make and how I go about my own research, which is very object focussed but linked to theoretical ideas and issues, so they are expressions and manifestations of sustainable theoretical issues and that's a big part about teaching sustainability or design for sustainability which I had been unable to get into so much in this particular course but that will be part of the imagination	39:15	Soc-Loc Des-PSS Sus-SSE Des-Res

	lab studio courses because what I see is a lot of research in design and this doesn't just apply to sustainability but you can include sustainability in it. What I see at the moment is a lot of research in design in this country and throughout the world where the design process is not part of the research and to me the value of design, the contribution of design is the transmutation from generalisations and abstractions and theories through the design process into specific defined examples, which manifest in particular examples so there to formed, there not every solution for every circumstance. But they are concrete manifestations of what those abstract theories mean and therefore although they are particular and they are not generally applicable because they are always specific they can be very powerful because you are no longer just talking about generalities you are actually saying well here is a concrete example here is one example of how that might be and that visualisation be it a piece of graphic design or object or a piece of architecture or whatever I think is a very powerful tool to discuss the issues around and I don't see that being used an awful lot particularly in product design. I don't see an awful lot of that kind of work going on. Antony Denn and Fiona Rabbi in the Royal college of Art do it, they use what they call critical design, which a good word I think critical design I used it myself to look at to use design within academia not to create viable objects but to encapsulate issues and to draw attention to issues and to discuss issues by making them concrete and making them specific. Now they do it in terms of the implications of new technologies and so on and emerging technologies I do it more in terms of sustainability to demonstrate the issues using the same kind of idea and so in my supervision and my studio class that's what I get students to address.		Studio-Make
Me	On the going back to the imagination lab obviously that is going to be run next year on a new course, but I noticed on the information about it on the website that it talks about interdisciplinary project work with other sites on campus as well as external client and partners. Obviously there isn't examples yet as it is going to be run next year but what sort of subject areas were you thinking of?	39:48	
A7	Well it will vary it depends who actually teaches the course if I'm involved with that course obviously I would try and run some of the projects to address sustainability issues for example there is a company in Alderston that does a lot of work in high tech applications with LED's wanting to get into more of a product market cause they do specialist applications at the moment and so that has environmental implications because it has a low energy, long lasting, robust light source. So having students explore what the possibilities are in terms of products and ranges of products and what the potential might be for that kind of thing and acknowledging what the disadvantages of that kind of lighting is as well would be useful for the company, would be useful design exercises for the students to understand	43:05	Ext-Coll Des

	some of the issues that companies are facing and we could focus it on sustainability for example. There is another company that we are working with at the moment in Leeds who are an electronic components supplier and of course localisation. My explorations of localised sustainable product design might be is the maintenance and part production of products at a more local level, that raises up the whole issue of you don't manufacture products in China and then ship them all over the world. You make products for local needs at a more local and regional level and then you repair them at the local level and you maintain them. It raises the issue of components and supply chains and different kinds of supply chains, will still mass produce things maybe in southern China but they would be components. They wouldn't necessarily be whole products and then at the local level you can make part of the product out of local materials perhaps depending what it is and through supply chains supply parts and components. So you can keep that product in use and maybe upgrading over time so the product changes over time at the local level so its kind of evolving in its usefulness and what it is, changing and metamorphosing at a local level. There is much less going to landfill because at the moment over 90% of our electronic products tend to end up in landfill, as is you know they are not taken apart and contain batteries, precious metals and toxic materials and all the rest of it.		Ext-Coll Soc-Loc
Me	How would it work on campus is there other departments that you might like to work with for instance?	43:09	Team-Dept?
A7	Well there's the business school that we are working with on the High wire programme and computing and there is also an engineering department and stuff like that. So it really depends on what the students interests are, we are not forcing them to work in an interdisciplinary way or with other companies if they have other interests but we will certainly be preparing projects that would enable them to do that.	43:30	
Me	Are the team based projects in that as well		
A7	There might be yeah I mean we haven't run one yet, so I think we will run both set up some set projects and then allow them to explore what their own interests are as well. Because there is two Imagination labs.	43:47	
Me	Do you think maybe and I don't want to put words in your mouth here but do you think there could be opportunities for say if it was setup for a student from design, a student from engineering, a student from environmental studies.	43:59	
A7	Well yeah that's a bit more difficult to do it would be nice, it's a bit more difficult to do because of timetabling and students doing set courses within their own areas. So they would have to register on an Imagination lab from engineering, computing and that would be counted towards their degree in computing to get there eventually. We are just concentrating on our own students at the moment and once they all see the value of that, they will all want to come. We are developing those relationships through the high wire PhD program and certainly we are doing these things within	44:50	Lim-Timt

	the high wire programme but that programme was setup specifically to do that.		
Me	Is there any opportunities with the current module for instance or even any opportunities in the new course for teamwork on existing modules where students all work together		Team?
A7	Well in the Imagination Lab yeah we will probably put them together in two's or three's to work on projects together yeah. In fact in the research methods course design thinking and research methods the way we did it in that course was we gave them a project and the project was healthy living on campus and there were four different areas that they could investigate related to healthy living on campus one was food another was sports and physical exercise another was mental health and wellbeing and another one was spirituality and religion. Interestingly out of all the groups and I think we have got three groups, they all focussed on mental health and wellbeing or spirituality and none of them focus on food or physical which we thought they would because they seemed more straight forward. But anyway for the teams we have got, one team of three and two teams of two to do the research, which is developing a research proposal, which involves primary research, primary data, observational data, interviews, survey data that kind of stuff to get primary data and to write a report, which analyses the data and forms conclusions and develops a set of design criteria to create an intervention to improve or whatever, whatever needs to be addressed, whatever they've identified that needs to be addressed to improve healthy living on campus in terms of mental health and wellbeing or spirituality whatever it is. They have to come up with some design interventions, so the research proposal which is the main part of the course, developing the research proposal doing the background reading in order to be able too develop a research proposal, writing a research proposal, carrying out primary data analysis, data gathering and data analysis and forming conclusions to the point where you get a set of design criteria to do an intervention that's joint that's group work. Once they have got the design criteria, then they do the individual part, so that there is a group assessed part and an individual assessed part. So once they have got the design criteria they go off and design their own intervention.	47:41	Team Res Obs Int Sur Team-Asm Ind-Asm
Me	Is there an opportunity in the group assessed part to maybe assess each other on the group work or is it more formally or not really?	47:50	Peer-Asm?
A7	Again informally they'll be presenting it, this afternoon actually to and again depending on time there will be an opportunity to get student responses back, so again it is informal and its through class discussions and presentations. Its not just handing in a paper it is sharing it with the class and asking you know for comments, questions, so there is that part. During the course they had to give presentations on their research proposal, so there	51:02	Peer-Pres Inf-Peer-Asm

	were other presentations throughout the course where we again invited the group to respond and to comment and raise questions for every bodies benefit really so that the other students can see what the other students are doing and how they are approaching their research proposal and what they are including and what they are not including so by sharing that information you can learn from each other in how they are approaching it you know expand your own thinking but if you present a research proposal and a student at the back of the class says yeah but have you thought about this then they can include that in it in theirs, they might not of thought of that and while the course instructors might think of some things students coming from a different background they might think of something completely different and as you saw in the class it's a pretty international class. There's two British students and all the rest were from overseas, now actually one of the groups looking at spirituality on campus, no one of the ones looking at mental health and wellbeing on campus, there is two groups doing that one of them is doing depression and stress related issues. The other group and they are British students because the makeup of that class is slightly different and there are three British students on the high wire program looking at depression, stress issues. The other group and both Korean students and they are looking at mental health issues and wellbeing but from but particularly from international student issues so language cultural, culture shock and just language all the issues that international students face and what the facilities are on campus to help them and how well those work and how they might be improved. So just having an international student go through that exercise and present it back to the class makes the students who are British students aware of what these international students are often going through that they might not be aware of. So that's the way they learn from each other.		Pres-Deb-Inf-Peer-Asm
A7	I'm gonna have to leave I'm afraid	51:05	
Me	Okay is it alright if I just one more thing		
A7	Yeah		
Me	You're not going to like this one, it's a tool but it's one of the questions I'm asking for my supervisor as part of her research and this is a tool that is used at Loughborough its part of the tools we offer through Information Inspiration and that's the Ecodesign web at the moment and in particular Vicky is looking at research and writing a paper on how to adapt this for a social sustainability so obviously the pupils look at each of these and then they rate their design based in each area, whether it is good or bad, so we are looking at replacing these topics with ones that relate to social sustainability. Now obviously because of the holistic nature it can be quite difficult but I was just wondering if there was any of those that you thought maybe one of them could be ethics or one could be design for behaviour change.	52:08	
A7	Well I think the problem with this is, the problem with this	52:16	Non-Sep-

	kind of approach to it is the same I pointed out earlier in class that it is separating the issues out.		Iss
Me	Yeah		
A7	And the triple bottom line, you have got the three aspects of the triple bottom line (drawing the sustainable design Venn diagram) or the quadruple bottom line but this is where it occurs right there so it's the interdependent relationship between all there right in the centre of the Venn diagram, which is where the problem lies and that is where the difficulty lies in juggling all those at the same time to just separate any one of those out and look at the issues in particular means that you're not dealing with it in terms of its relationship to the other two, or the other three if you introduce the quadruple bottom line. So I mean the social issues, you know there is social equity, social justice, meaning, substantive values, culture, those kinds of issues but if you put. Where would I put something like localisation, because localisation is a really big part. If you read Sim Van der Ryn's and Stuart Cowan's book ecological design, they point out there and others have done this as well the importance of localisation and particularities of place. If you read Christopher Day's book Architecture of the soul, spirit and place, it's all about localisation and place. Now part of that is materials of place, material selection, materials usage, product use, end of life, optimal life, all that about the notion of materials and place as came up today with the natural materials with the world map why bring them from all over the world use then of place, materials of place that is an issue of localisation.	54:09	Sus-4Btl Soc Soc-Equ, Soc-Just, Per-Mean, Soc-Cul Soc-Loc Env-Res, EOL, Env-Dur
Me	It's the skill	54:11	
A7	But it's also local skills, local livelihoods, fir within the landscape creating a culture and a sense of wellbeing, belonging and cultural identity. You can't separate them you see, they are all interwoven and that's the difficulty of sustainability, were used to dealing with discrete issues from a faulty of science and a faculty of arts and within the faculty of science we have the department of physics and the department of. We separate all these things out and that's what we do to make them simple and reductionist. But that is where the problem lies it's about integration, it's about holistic views of things, it's about trying to keep all these balls in the air at the same time and have this incredible juggling act, it's not easy. So whenever I see a diagram like that about sustainability, which separates things out, I think what we be is joining things up is what we need to be doing. So that is where I would see the weakness there, so maybe the layers on top of that rather than a separate one.	55:12	Soc-Loc Soc-Well Int Hol-Sus
Me	Yes I did suggest earlier in the year about having several layers of tracing paper to keep going through them.		
A7	Ahh and you see how complex it gets	55:18	
Me	But No thank you for that it's been really helpful		
	End of Interview	55:31	

APPENDIX I. Excerpt from the Limitations identified in the teaching of SPD cluster

Ind	Level	Quote	Code
A5	BSc	that is when you fall into the environmental trap because it is easiest and it is the less complicated to explain to them.	Diff-Sus-Soc
A3		But it's so hard isn't it, defining the impact of a product in relation to the environment is much easier than saying has someone in society been disenfranchised by the development of this. How would you begin to understand that.	Diff-Sus-Soc
A3		It's a harder thing to define I think, which is probably why it hasn't been done really.	Diff-Sus-Soc
A6	BA/ MA	And the users as well. The groups, the user groups, the stakeholder groups, all sorts of different things. And it is a very, very complicated scenario. So to come back to the question, it is a very, very difficult thing to unpick.	Diff-Sus-Soc
A8	BA	You asked about barriers, potential. One of the first ones that I will mention would be the availability of material, the cost. The prime example is bamboo. Students are very keen on bamboo, even travelled to China for a few weeks to study it. Found that when they got back there is no way to continue experimenting because it is not available here. Only recently has bamboo been available in the UK and we have been trying to get a hold of that for about three years. So the other thing is that we also had the Centre of Sustainable Future fund our material supply. So they provided an amount so that all the free materials in our workshop that students get to are upgraded from the run of the mill chip board.	Lim-Mat
A9	BA	I suppose the biggest barrier is the size of the group because when we first started teaching you might have 40 students which is great because you can work in smaller groups and get a much more collaborative way of learning rather than having to you know use big lectures …. as it has become more popular it has actually become more difficult to teach in the way we want to teach it because we don't want it to just be them listening to us we want them to be quite active and to take part in stuff. So we are always looking for ways to break them into smaller groups so we have them for the tutorial sessions in groups of 28 ish 28 to 30 which is fine but its still quite a big group….. they get much more out of it in the smaller groups. That is my concern about making it core in that they there is no way we could teach it even as we do now with 130 students	Lim-Num
A5	BSc	So I think the fact that the environmental one seems to be the best solution and even when you are teaching it you fall back on it. Because when you are talking to a group of 150 people and you are trying to get it across that there are social aspects to it and there are environmental…… but when you have got a bigger group you know I fall back on the environmental ones as tools because I want to know that they have something to take away from the lecture that they have to learn something and the tools are the easiest way to do it.	Lim-Num

APPENDIX J. Limitations in the teaching of SPD

CODING MEANINGS

Code	Description
Lim-Timt	Timetabling limitations
Lim-Exp	Expertise limitations
Lim-3D	The need to produce a 3D object can be a limitation to PSS solutions.
Lim-Risk	Perceived student risk in pursuing a non-conventional design solution.
Diff-Sus-Soc	Difficulty understanding the social aspects of sustainability
Lim-Num	Limited by the large group size
Lim-Know	Limited knowledge or understanding
Lim-Pop	Challenge of a popular option and how to teach large groups
Lim-Mod	Limitations of the modular system can cause students to compartmentalise.
Lim-Itg	Sustainability is intangible so students find it hard to apply
Lim-Cont-Learn	Contemporary teaching structure restricts learning opportunities
Lim-Stud-Const	Students are constricted in their general design creativity because of their strong attitudes to sustainability
Tool-Lim-Und	Tool approach can prevent students seeing the wider issues
Lim-Soc-Tea	More difficult to teach the social aspects.
Lim-Soc/Env	Easier to teach just environmental aspects to large groups in lectures than social.
Lim-Comp-Sus	Recognising that compromises will need to be made.

APPENDIX K. STUDENT QUESTIONNAIRE 1

Please could you complete this short survey it will be compared with a 2nd survey at the end of the module to help to measure the effectiveness of some new teaching on this module.

The questionnaire is anonymous and responses will be held in the strictest confidence, the responses will be used only by a PhD student to clarify students' attitudes and awareness to emerging design fields.

1. This survey is part of a wider study being conducted at other universities in order to ascertain the breadth of the survey responses could you indentify below your:

    a. Home town and region

    _____

    b. Your previous school, sixth form or college

    _____

2. Considering the following terms could you identify your current level of familiarity of them? (This isn't a test of your knowledge of a reflection of your teaching)

	I understand the term	I've heard of term	I've never encountered this term	Please indicate if you have been taught term
Sustainable Design				
Design Against Crime				
Inclusive Design				
Responsible Design				
Design for the Underprivileged				
Design for Behaviour Change				
Design for the Aged				
Emotionally durable Design				
Design for the other 90%				
Ethics of Design				
Localisation				

3. Can you give a short description of your understanding of Sustainable Design?

4. Please rank the following design considerations **1 to 10**, in order 1 being in your opinion the most important and 10 the least important?

	Rank		Rank
Aesthetics		Inclusivity	
Affordability		Manufacture	
Ethics		Market	
Form		Product Purpose	
Functionality		Usability	

5. Can you give a short description of your understanding of Social Design? Please give examples if applicable.

6. Please select the **ONE** most appropriate statement, to describe your personal approach to design projects?

    a. I aim to fulfil solely the requirements of the design brief given
    b. I enjoy discovering new technologies and applying these to my work were possible within the brief
    c. I particularly like to create something new, different or unique addressing currently unmet needs

d. I seek to find the most appropriate solution to the problem in the shortest time possible
e. I have a particular passion for addressing the needs of underprivileged groups of people that are unmet, my design approach may be more applicable to charitable organisations than profitable organisations
f. I prefer to adopt an approach of designing high end luxury goods

(All the statements above are equally valid stances and the research is more concerned with your first impression than what seems preferable to others).

Thank you for your participation, if you have any questions the researcher can be contacted by email: M.A.Watkins@lboro.ac.uk

APPENDIX L. STUDENT QUESTIONNAIRE 2

Please could you complete this short survey it will be compared with a 1st survey undertaken at the start of the module to help measure the effectiveness of some new teaching on this module.
All responses will be held in the strictest confidence the responses will be used only by a PhD student to clarify students' attitudes and awareness to emerging design fields.

1. Name: _____ (optional)

2. Considering the following terms could you identify your current level of familiarity of them? (This isn't a test of your knowledge of a reflection of your teaching)

	I understand the term	I've heard of term	I've never encountered this term
Sustainable Design			
Design Against Crime			
Inclusive Design			
Responsible Design			
Design for the Underprivileged			
Design for Behaviour Change			
Design for the Aged			
Emotionally durable Design			
Design for the other 90%			
Ethics of Design			
Localisation			

3. Can you give a short description of your understanding of Sustainable Design?

4. Please rank the following design considerations **1 to 10**, in order 1 being in your opinion the most important and 10 the least important?

	Rank		Rank
Aesthetics		Inclusivity	
Affordability		Manufacture	
Ethics		Market	
Form		Product Purpose	
Functionality		Usability	

5. Can you give a short description of your understanding of Social Design? Please give examples if applicable.

6. Please select the **ONE** most appropriate statement, to describe your personal approach to design projects?

g. I aim to fulfil solely the requirements of the design brief given	
h. I enjoy discovering new technologies and applying these to my work were possible within the brief	
i. I particularly like to create something new, different or unique addressing currently unmet needs	
j. I seek to find the most appropriate solution to the problem in the shortest time possible	
k. I have a particular passion for addressing the needs of underprivileged groups of people that are unmet, my design approach may be more applicable to charitable organisations than profitable organisations	
l. I prefer to adopt an approach of designing high end luxury goods	

(All the statements above are equally valid stances and the research is more concerned with your first impression than what seems preferable to others).

7. Please describe your reaction in respect to the ‘Rethinking Design’ presentations and activities delivered by the visiting Loughborough University researcher.

8. Please select the **ONE** most appropriate statement, to describe your personal response to the ‘Rethinking Design’ activities and presentations?

Activity	**1st**	**2nd**
a. I didn’t understand the relevance of the activity to Product Design		
b. The material delivered was interesting but unfeasible		
c. The material delivered was thought provoking but irrelevant to my work		
d. The material delivered was thought provoking and interesting		
e. The activity inspired aspects of my project work/essay		
f. I directly used aspects of the activity in my project work/essay		
g. The activity changed the course of my project work/essay		

9. What would you describe as the most important or memorable aspect of learning from this module, what aspect has had the greatest impact on you or your design practise?

10. The researcher may wish to ask further questions regarding your experiences from the module if you would be willing to take part please give your contact details below:

    Email address _____

Thank you for your participation, if you have any questions the researcher can be contacted by email: M.A.Watkins@lboro.ac.uk

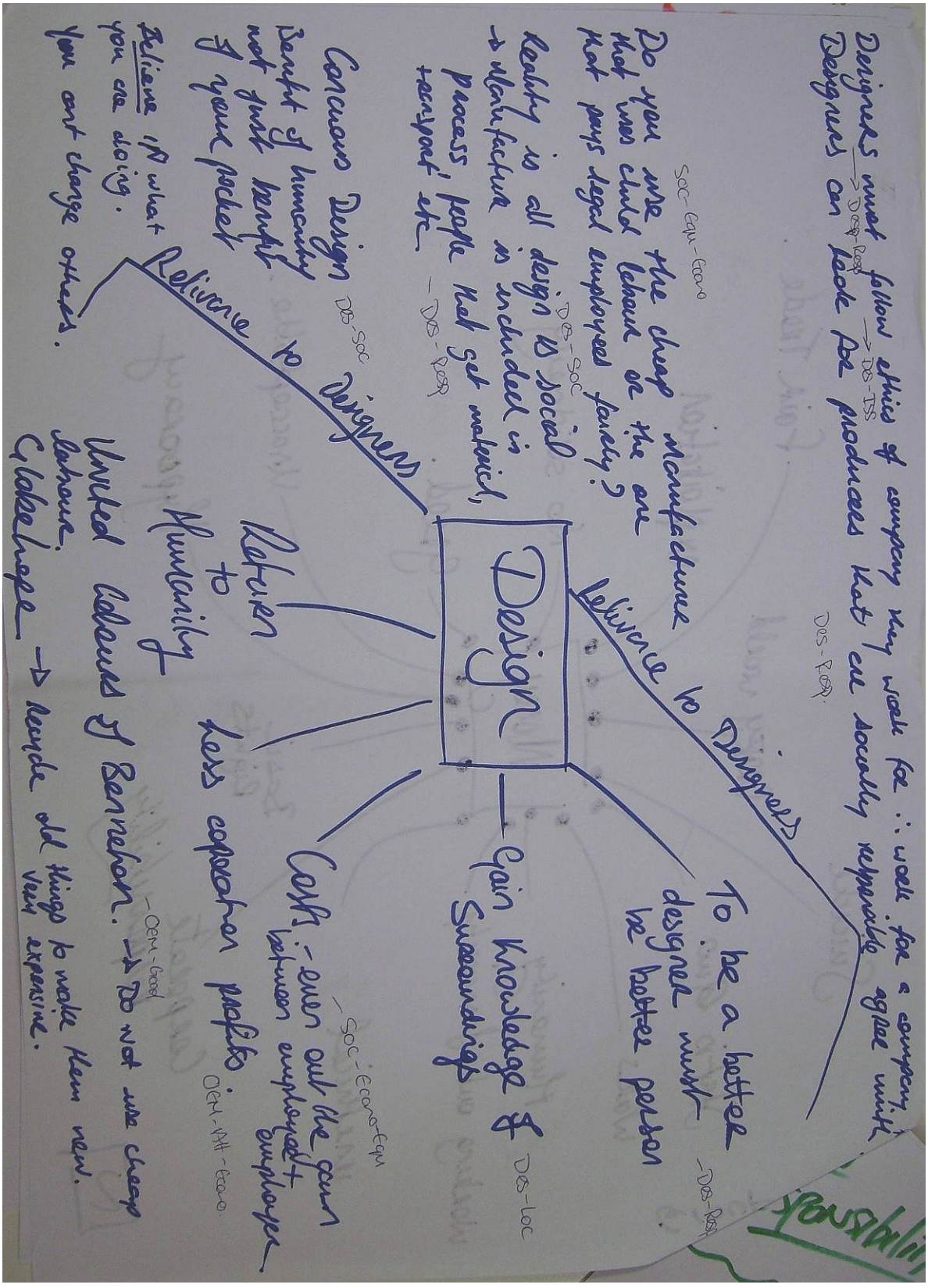
APPENDIX M. EXAMPLE AUDIO TRANSCRIPT FROM THE RETHINKING DESIGN SERIES WORKSHOP

CL1T Comments GP2	**Code**
This environmental use down cycling you want to encourage people to, do you want to wait to get your stuff in place before we start talking?	
Emotional attachment which goes to. What is happening is people are buying a lot of things, you buy different things. Getting rid of the throwaway society, it's more than customisation it's preventing buying a different thing. If you can customise it you love your things. This idea of .. the product customisation and personalisation. Gives you a feeling that its yours, ownership yeah ownership. This allows you to then create something which allows you to cherish it. Still the point of the first car maybe your first product is not good enough, you are attached to something I love it, but you don't want to keep it anymore. You wouldn't want to be in the same car. It's a starting block absolutely.	Emo-Dur-Att Soc-Waste Per Soc-Per A/V-Emo-Dur-Att
If you look at this what I see is this is what we have got now and we know this is where we need to end up but we are stuck here because people don't want to do it because people are lazy. So by going this way and creating emotional by personalisation you can then get round it by getting people to throw away. This is only one type of thinking, one direction. I we focus on this how are we, what do you want as an outcome from this, yeah because we have got a definite loop but this is only one direction. What do we do know?	Soc-Waste Soc-Att Emo-Dur-Per Soc-Waste
Basically we all know where we want to get to, so we need to get rid of the throwaway society. But we are blocked from doing that because currently people are lazy. So we can't do that directly, so looking at this the other slides the first car, the attachment, if you then took that direction you would all eventually lead to this because you wouldn't. If you customise it then it is a product that costs money so you are much more likely to keep it for a much longer time.	Soc-Waste Soc-Att A/V-Emo-Dur-Att Per+ve
It is the personalisation of a good which makes you perceive it as ownership so if instead you say okay but this pen it's a horrible thing. If I went this is my pen, someone bought it for me and gives it a personal aspect then it would change some of the perception of it just being a pen. If you change the perception of it to change and interact with it and people thought you could use it. It's like the glasses you are wearing you don't go I'm going to throw them away, tomorrow I'm going to get a new pair because they are yours. If someone had the same pair of glasses as you do. Now if someone had a pair of glasses they are the same what are they called, same magnification, you would swap because the glasses you wear are yours… They suit the shape of my head, discussing glasses.	Per-Att Emo-Dur-Att
CL2T Comments GP1	
Up cycling. Do you want to move round here?	
Banjo, pallet chair, coffee tin thing, coffee roaster. What about these green in relation to plants …… fish was there fish in there, yes and there was lots of water? Oh the tins was it. Waste, up cycling adding value utilisation 2nd life type thing. 2nd life adding value, 2nd life is good.	A/V-Reuse A/V-Reuse-2nd Life

Things that are coming back 2nd life, up-cycling, coming back it's like sustainability. Like we said this morning, like using it less bad, no not making it less bad. In this mind map 2nd life is coming up so using it for something modern.	Reuse-2nd Life
Next slide if you have exhausted that, read through slide questions.	
CL3T Group 2	
For undeveloped countries I think it would be amazing but for me personally because I wouldn't want that thing in my house, it's going to be splintery it's not going to be comfortable. But it does its primary job, but you need to source hammer and nails to put that together.	A/V-Reuse
Me - I would just like to explain the pallet chair I probably should have amended it this was an issue when I first used this. It's a charity setup that project in lugana they bought the plans for them and gave them all the stuff they need to make the chairs.	
Was it a way to make money or a way to have their own furniture?	
Me – It was a way for them to sell to make money	
Like the big issue. Where were they getting the pallets from?	
It said damaged pallets, students discussing pallets	
How could the pallet idea not be a good idea? Did they give them the tools, provide them with the tools. Lots of questions about the pallet chairs.	A/V-Reuse
Off topic sillyness and discussing the Nano	
Pallet, I think it is a good idea, what could possibly be bad about it. You are employing the local people you are giving them the means to make profit. I would say it is sustainable, yes it is sustainable. But not everyone can use hammer and tools this workshop even if you read the instructions.	
You train people and then they train other people and so on.	
I explain the pallet chair principle more.	
What happens when they run out of pallets they are going to start stealing them? Well if you look back really far in sustainability there shouldn't be pallet in the first place, they should be recyclable.	
Existing examples, reinvent design, everything is so ingrained and people are like no I don't like recycling or yes I am really into that and I'll put out all my things. But my dad won't give a **** he will throw away stuff and my mum will get it out the bin and put it out right. We have got to look at ways at ingraining the right stuff like teaching, is it taught in schools. I didn't learn about this.	Des-Think
Off topic discussing society.	
Next slide so relating this to your projects both **group 1 and 2** below	
Very open project	
Actually we thought of doing some kind or artefact or exhibit, we came up with a replacement part of a product. Let's discuss artefacts for an exhibit and how it could change the social behaviour.	Des4BC
What could we do in our project that he showed on the PowerPoint, localisation, and emotionally durable design. Any of the products you could use, yes the second life one. How would the project that we are doing benefit the environment, making people more aware maybe. Using material that is in abundance and benefits. So that it lasts long enough that it can be handed down.	Loc Des-Emo-Dur Soc-Aware

So let's take examples yeah and the plastic that is going to come out of this material let's look and what we are going to do with it and how we are going to do it that way. It's got to be reprocessed first, let's start down here localisation that is one think we want to go for. Let's use Howie's as an example, I like Howie's. Localisation we want to try and link it so you don't have to go miles and miles away to make the product. Stop travelling either by boat or train.	Loc Loc
Sustainable to form materials into	
What about taking the ideas of the crates and thinking second life so maybe something we don't think of one way but somebody else might see something else in. So one man's waste is another man's treasure. With the plastics we have we want them to be really high quality if we take them to a third world country they just need something.	A/V-Reuse-Quote
Something green, something that will make them feel good for the environment.	
Discussing Egypt as a third world country going a bit off topic.	
Something that seems alive something that grows, think about our growing stuff that Roger was talking about something that changes with you because that is the think these things you have an emotional; bond to it's usually because they have got old and tattered.	Emo-Dur-Att
Perhaps this product could be used in some way like in the presentation as some sort of aid tool. Some sort of charity program that provide it with for helping.	Des-Soc-Need
Memory something less specific something that holds memories so you can plant things from a certain era like a time capsule something like that. That we could see and have a constant memory of something. We could make a sculpture that could store things maybe I don't know. Like memories or, have you heard of a time capsule where you store things and dig it up in years' time and you find things. Something like that it's got emotional, it's got personal meaning. I don't know in what form. I would be nice if it could capture something that is in some way alive.	Des-Emo-Dur Emo-Dur Per-Mean
You know an egg container that is used to protect eggs this type of packaging could be quite sustainable.	
Discussing the plastic waste that they have to design with.	
Off topic noise in the background. To End	

APPENDIX N. EXAMPLE MIND MAP FROM RETHINKING DESIGN SERIES WORKSHOP



APPENDIX O. WORKSHOP CODING MEANING SAMPLE

Code	Description
Afford	Affordability
A/V-Old-Deep-Lone	Recognising loneliness of elderly in A/V introduction – demonstrating deep learning
Des-Cult-Div	Designing for a life they have no experience of
Des4BC	Design for behaviour change
Des-Emo-Dur	Design for emotional endurance
Des-Iss	Design Issues
Des-Loc	Design for localisation
Des-Resp	Designers responsibilities
Des-Soc	Design for society/social design
Des-Soc-Need	Design for social need
Des-Think	Design Thinking
Des-Under	Design for the underprivileged in society
Emo-Dur	Emotionally durable
Emo-Dur-Att	Emotionally durable attachment
Emo-Dur-Per	Emotionally durable through personalisation
Loc	Localisation
Per	Personalisation
Per-Att	Personalised attachment
Per+ve	Positive benefits of personalisation
Per-Mean	Personal meaning (sense of/developing)
Res-User	User Research approaches
A/V-Reuse	Reuse relating directly to introduction
Reuse-2nd Life	Reuse – secondary life relating to introduction
Soc-Att	Social/Societal attitudes
Soc-Aware	Encouraging a social awareness of issue
Soc-Basic-Need	Addressing/providing basic needs of society
Soc-Econo-Equ	Social economic equity/workers' pay etc
Soc-Expl	Exploitation of workers/community etc
Soc-Waste	Society's attitudes to waste/inherently wasteful

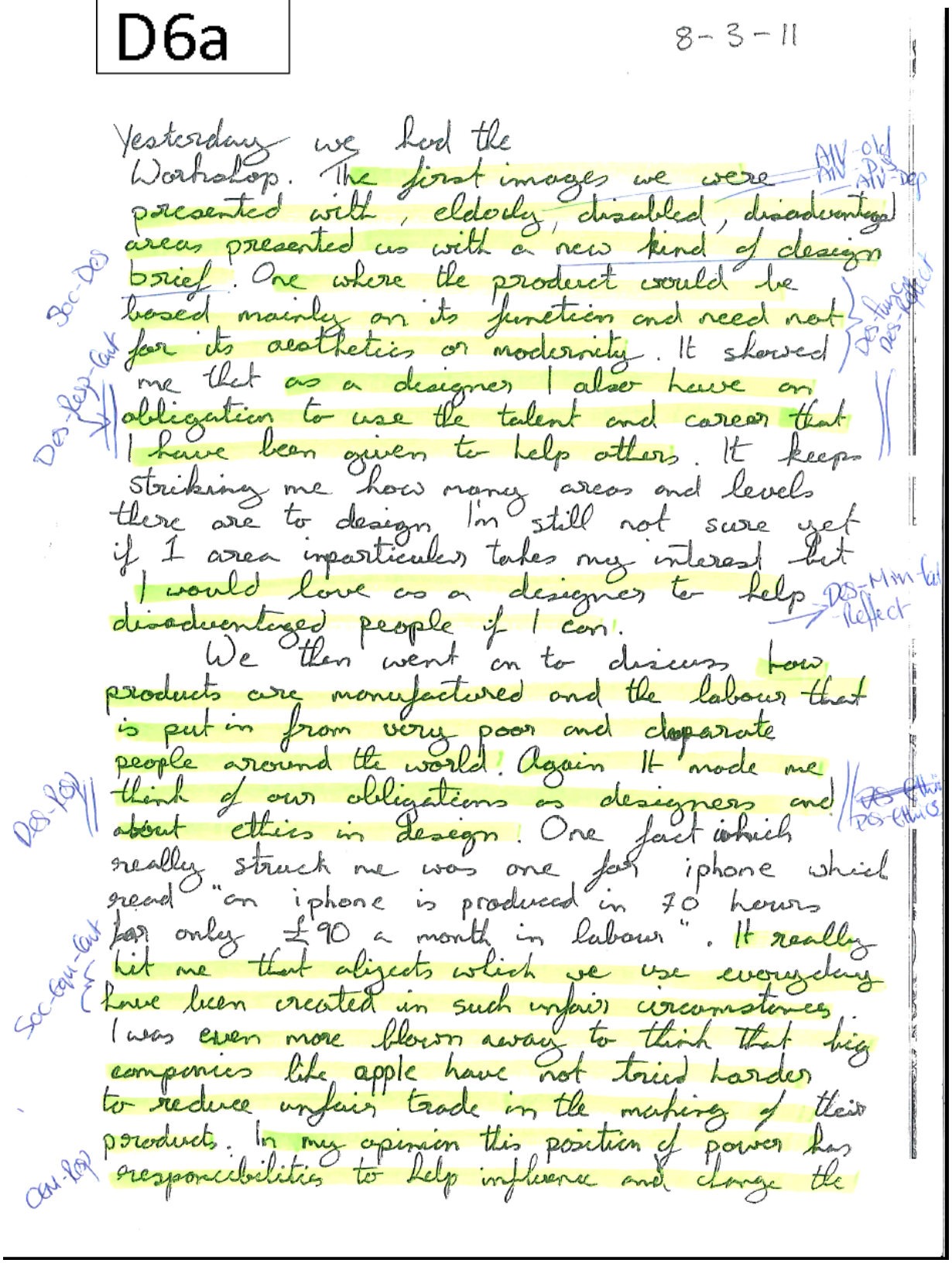
APPENDIX P. DIARY CLUSTERING

Ind	Code	Evidence (Thread)
M O'C	Ques-Reflect	*First step we tool was to complete a survey to find out own knowledge of different types of design. On completion of this survey I found a number of areas of design I didn't know about for example sustainable design.*
Sn	Ques-Reflect	*Were asked to fill in a survey on aspects of design. It asked us what we felt about features of design such as designing for environment and community and what our initial feelings or knowledge was on these aspects of design.*
Sn	Ques-Reflect	*After the workshop we were then asked to fill in the same survey as we did before the workshop. This was interesting because my thoughts and knowledge of the aspects had changed or broadened. The videos and subsequent discussions had broadened my thoughts on the power of designing, that as well as functionality, aesthetics and a message, a design can have social benefits and bring people closer together of help make people's lives better.*
Th	Ques-Reflect	*The last thing we did was re-fill out the survey….After filling it out again I found that I had learned a lot bout design.*
Cs	Ques-Reflect	*Prior to the workshop we filled out a survey on different types of design and what we understood about each type of design so after the workshop when we filled out another survey he could see how beneficial his workshop was.*
RG	Ques-Reflect	*The purpose of the survey was to determine how much every student understood about design. In my opinion, this was a good start to the workshop. It helped me to determine what I needed to know after finishing the workshop.*
RG	Ques-Reflect	*After watching the video and discussing the topics, we all had to complete a second survey individually….. I believe that this was an excellent way to end the workshop. It showed how much we learned from the presentation and the difference from what we knew at the start.*
Gr	Ques-Reflect	*We firstly filled out a survey about our knowledge of design and what we thought about the different areas of design. We learned many different areas of product design even ones I had never heard about before.*
Jl	Ques-Reflect	*We were handed out a survey to complete about different areas and considerations for design. I actually did not know some of the topics listed on the survey. But I was sure that these topics would be dealt with in the workshop.*
Jl	Ques-Reflect	*By the end of the class I understood all the terms that were questioned about at the start of the workshop, Localisation, social design.*
RG	A/V-Eff+ve	*I found the second video which was about exploitation both extremely effective and highly shocking.*
RG	A/-Eff+ve	*The final video (localisation) was as effective as the second one.*
RG	A/-Eff-ve	*In my opinion, the first video (step into my world) was not fully effective. It made its point clearly, but not effectively….some clips that were effective were a wheelchair user out and about, and another with women who adapt different styles of fashion depending on their culture. Clips including the one with a rundown building were not effective. I found it difficult to understand the point*

		being made.
Br	A/V-Style+ve	*The videos were no longer than 3-4 minutes and were interesting portraying different themes.*
Sn	A/V-Style+ve	*This was a good exercise as the videos were always very thought provoking and evoked discussion and opinions from everyone*
Sn	A/V-Style+ve	*The videos and subsequent discussions had broadened my thoughts on the power of designing, that as well as functionality, aesthetics and a message, a design can have social benefits and bring people closer together of help make people's lives better.*
Cs	A/V-Style+ve	*Final set of slides was the most interesting in my opinion as it looked at sustainable design where reusing used products for another purpose.*
Rb	A/V-Style+ve	*I really liked the videos that were shown. As simple as the videos were I felt they were very powerful.*
Rb	A/V-Style+ve	*The video was just a normal video with a few photos, but it was the wonderful selection of photos that made me stop and think. I liked the photos they were very striking for me; they highlight the people in society we sometimes forget about.*
Th	A/V-Style+ve	*Last video was about cultural identity, global and local goods and secondary product life. I found this video particularly interesting. The personalisation of products seemed to spark an interest in our group as did the secondary product use. I found the personalisation of products interesting because it is something I do myself all the time and the secondary uses were interesting because of the interesting way they re-used products. It is also a great way of cutting down on waste*
Eo	A/V-Style-Emo	*This video was the most shocking one out of the three, because everyone can relate to one of more of the products that were shown on the video.*
RG	A/V-Style-Emo	*I found the second video which was about exploitation both extremely effective and highly shocking.*
Rb	A/V-Style-Simple	*As simple as the videos were I felt they were very powerful.*
Eo	Work+ve	*I felt this workshop was important as we had a glimpse into how large organisations exploit third world economies and the population*
Jl	Work+ve	*I actually really enjoyed this workshop and learned a lot about designing for different target audiences*
Rb	Work+ve	*We had to group with people we don't normally group with, which was quite good because we saw different opinions.*
Cs	Work+ve	*Overall I thought the workshop was very beneficial as it opened my mind to looking beyond the obvious problem and look deeper into the situation to come up with a good solution.*
Sn	Work-Disc-Learn	*The videos and subsequent discussions had broadened my thoughts on the power of designing, that as well as functionality, aesthetics and a message, a design can have social benefits and can bring people closer together or help make people's lives better.*
Sp	Work-Style	*Today's workshop was very different to previous ones. It dealt with the dark sides of life such as child labour, suicide, lonely elderly people, people with special needs and deprived disadvantaged areas.*
Br	Reflect	*But this got me thinking about everything I use every day. How do I*

		know the letters that I pound whilst I type this out was not placed by an 11 year old girl or a father with 4 kids struggling to put food in their mouths working 16 hours a day for next to nothing.
Sn	Reflect	*I thought about how a simple design or idea can have a big impact. Not on a consumer of an item, but on a community or a way of life. It made me really think about the power of design, as well as the responsibilities of designers to stay relevant and that as well as being fashionable or popular, that great design has an important message, or in this case an important cause. Design can make simple changes, and that they should do what they can for others and not just leave the big issues to politicians. Designers have the opportunity to do important work and for it to be as good and as respected as a something whose sole purpose is aesthetics or functionality.*
Cs	Reflect	*Overall I thought the workshop was very beneficial as it opened my mind to looking beyond the obvious problem and look deeper into the situation to come up with a good solution.*
Cs	Reflect	*The presentation made me focus and think in a design state about the images on each slide and how I could come up with a solution to each slide or even one solution that would work for all the people in the slides.*
Rb	Reflect	*Technology is getting more and more sophisticated with every day that goes by but as we improve technology we are complicating things for different people in society.*
Kt	Reflect	*The first images….presented us with a new kind of design brief. One where the product would be based mainly on its function and need not on its aesthetics or modernity.*
Kt	Reflect	*It keeps striking me how many areas and levels there are to design I'm still not sure yet if 1 area in particular takes my interest but I would love as a designer to help disadvantages people if I can.*
Kt	Reflect	*….so maybe it is fair to ask if there is a need to mass produce items on such a large scale with such negative outcomes? (concluding remark)*
RG	Reflect-Cont	*The worst aspect was showing the examples of the products they make. It reminds us that products that give us pleasure and enjoyment were made in these environments.*
Kt	Des-Reflect	*It showed me that as designer I have an obligation to use the talent and career that I have been given to help others.*
Eo	A/V-Afford-Reflect	*Images were shown of the amount of pay the workers would get in relation to food. Bread and soup was an expensive commodity to them.*
Eo	A/V-Expl-Reflect	*The next video detailed manufacturing in third world countries. It showed us images of the cramped working conditions and the areas they had to work in.*
Kt	OEM-Resp-Reflect	*In my opinion this position of power has responsibilities to help influence and change the situation in countries like this not to make it worse.*
Sp	Soc-Expl-Reflect	*Personally I would not like to work for a company endorsing child labour. It's bad enough that most adults are stuck working most of their lives, but children deserve to be free.*

APPENDIX Q. EXAMPLE STUDENT DIARY



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8-3-11

Yesterday we had the Workshop. The first images we were presented with, elderly, disabled, disadvantaged areas presented us with a new kind of design brief. One where the product would be based mainly on its function and need not for its aesthetics or modernity. It showed me that as a designer I also have an obligation to use the talent and career that I have been given to help others. It keeps striking me how many areas and levels there are to design. I'm still not sure yet if I area in particular takes my interest but I would love as a designer to help disadvantaged people if I can.

We then went on to discuss how products are manufactured and the labour that is put in from very poor and disparate people around the world. Again it made me think of our obligations as designers and about ethics in Design. One fact which really struck me was one for iphone which read "an iphone is produced in 70 hours for only £90 a month in labour". It really hit me that objects which we use everyday have been created in such unfair circumstances. I was even more blown away to think that big companies like apple have not tried harder to reduce unfair trade in the making of their products. In my opinion this position of power has responsibilities to help influence and change the

APPENDIX U. STUDENT DIARY CODING SAMPLE

Code	Description
A/V-Afford-Reflect	Student reflecting on the nature of poverty and affordability in the A/V introduction
A/V-Des-All-Cont	Student reflecting on the need to design inclusively
A/V-Eff+ve	Describing the A/V introduction format as effective
A/V-Style+ve	Positively describing the A/V introduction format
A/V-Style-Emo	Describing the emotive nature of the A/V intro
A/V-Style-Simple	Positively describing the simple style of the A/V introduction
Cont-ID	Student recognising how peers had contextualised the workshops in different/individual ways
Des-Imp	Recognising the social impact that designers have
Des-Min-Cont	Student noting desire to design for minorities
Des-Resp-Cont	Student reflecting on their personal responsibilities as a designer
Des-Think	Demonstrating a design thinking approach to issues
Group-Disc	Describing the benefit of the group discussion
Ques-Reflect	Student reflecting on the questionnaire purpose/benefit
Reflect	Evidence of student reflection on their place as a designer/consumer
OEM-Resp-Reflect	Reflecting on the responsibilities of large corporations
Soc-Cult-Div-Cont	Student contextualising cultural diversity
Soc-Emo-Cont	Student contextualising the issue
Soc-Equ-Cont	Student contextualising the issue of social equality
Soc-Expl-Cont	Student contextualising the effect of exploitation
Work+ve	Positively describing the workshop format/learning
Work-Disc-Learn	Describing how the workshop and discussion has improved their learning