Sustainable Construction in the 21st Century: An Educational Perspective to Shifting the Paradigm

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Declaration

I declare that the work presented in this thesis is entirely my own and that where other sources of information have been used, every effort has been made to indicate this clearly.

Michelle Brennan

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Abstract

Sustainability is a ubiquitous topic debated across the globe. The potential of the construction industry to alleviate the effects of environmental damage whilst contributing to the social and economic dimension of sustainability are great. Despite many efforts by both Government and Higher Education Institutions, the adoption of sustainable construction practices is well below where it needs to be. Much work needs to be done in reprogramming the minds of those in an economically facing industry to ensure a sustainable future. This research looks at the efficacy of an educational intervention for such change and the use of psychological variables in assisting the process. This thesis contributes to original knowledge through the development of a validated measurement tool designed to measure attitudes towards sustainable development in a construction context. The tool was used to investigate associations between attitudes and psychological constructs. The research makes a further contribution through the development of an educational intervention which supports the use of alternative pedagogies for sustainability education.

The research was conducted in four phases, with phases one and three making the contribution to knowledge. A concurrent mixed methodology approach was adopted utilising an embedded design. Quantitative data was collected in phase one with this phase running concurrently alongside the other phases throughout the project. Qualitative data was collected in phases two and four with phase three adopting a mixed model approach.

The conclusions drawn from phase one were that there are associations between emotional self-efficacy and positive attitudes towards sustainability but not with optimism. Phase two highlighted that changes in attitudes towards sustainability would need to be driven through, legislation, education and leadership. This resulted in the development of an intervention with students at LJMU based on principles of student-centred learning. Analysis of the student feedback indicated that the intervention had a positive impact on students with perceptions changing as to how important sustainability is and how important the construction industry is for this to be achieved. The intervention tool developed within this research has the potential to be adapted for use with a wide variety of audiences, in particular those in positions of high level decision making. A top-down and a bottom-up approach is recommended if we are to achieve the aspiration of a sustainable future.

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List of Abbreviations

A21 – Agenda 21

BIM - Building Information Modelling (BIM)

BRE- Building Research Establishment

BREEAM – British Research Establishment Environmental Assessment Method

BUE - built environment

CIOB – Chartered Institute of Building

CIRIA - Construction Industry Research and Information Association

EI - Emotional intelligence

ESD - Education for Sustainable Development

ESE - Emotional Self-efficacy

G4C - Generation for Collaboration

GCB - Green Construction Board

GSL – Government Soft Landings

HEI – Higher Education Institution

ICE – Institute for Chartered Engineers

LA21 – Local Agenda 21

LEED - Leadership in Energy and Environmental Design

LOT - Life orientation test

MMC - modern methods of construction

NFB – National Federation of Builders

PM - Project manager

RIBA – Royal Institute of British Architects

RICS - Royal Institution of Chartered Surveyors

SC - Sustainable construction

SCL – Student Centred Learning

SCPs – Sustainable Construction Practices

SD – Sustainable Development

SE – Self-efficacy

WBCSD - World Business Council for Sustainable Development

1. Introduction

Sustainable Development (SD) is a topic that has gained much attention over the last 30 years since the publication of the Brundtland report (WCED, 1987) however, despite an increasing number of studies highlighting the importance of sustainability in construction projects (Medineckiene *et al.,* 2010), progress towards the same within the construction industry is slow compared to other industries.

The built environment provides the context for most human activities with a constructed environment necessary for society to live, work and fulfil social and other needs (Raynsford, 1999). It is one of the largest sectors of the UK economy contributing almost £90 billion to the UK economy (6.7%), comprises of over 280,000 businesses and employs over 2.9 million people, which is equivalent to about 10% of total UK employment (BIS, 2013). By contrast however, construction activities leave behind significant environmental and carbon footprints (Chong *et al.,* 2009), with cities being a source of global environmental pollution and ecological damage as they serve as major sinks for materials, energy, and pollution (Medineckiene *et al.,* 2010). Environmentally the sector is responsible for high-energy consumption (50% of worldwide energy usage), solid waste generation, global greenhouse gas emissions, external/internal pollution and resource depletion (Ortiz *et al.,* 2009) with construction consuming 40% of raw materials extracted (Bribian *et al.,* 2011). In addition, on-site construction activities can also result in soil and ground contamination, surface and underground water contamination, construction noise and vibration, dust, hazardous emissions and odours, impacts on wildlife and natural features and archaeology impacts (Chen *et al.,* 2005).

The detrimental impact the construction industry has on the environment is not new knowledge. Organisations such as the UK's Building Research Establishment (BRE) and the Construction Industry Research and Information Association (CIRIA) have spent decades researching and documenting such impacts of the building industry (Murray and Cotgrave, 2007) and reports such as Latham (1994), Egan (1998) and Wolstenholme (2009) have long documented the shortcomings of industry also. Yet despite growing awareness of these issues, progress towards sustainable practice in the construction industry continues to be

slow compared to other sectors. The recent Government Strategy 'Construction 2025' (BIS, 2013) further calls for change within the industry outlining a vision for a more attractive and technologically advanced industry that through integration and collaboration will allow the construction industry to grow sustainably and make a long-term contribution to growth. The strategy follows on from previous strategies (HMG, 2005; Cabinet Office, 2011) in which the Government outlined its commitment to moving the sustainability agenda along and what should be done by industry to help achieve these commitments including education and creating leaders for a sustainable future. Achieving true SD involves taking a holistic approach incorporating social, environmental and economic aspects. The construction industry has been identified as being in a position where it can contribute significantly to all three aspects of SD firstly because of the significant impact that building activities have on the environment, and secondly because of the social and economic impact it creates (Myers, 2005). The construction industry is renowned for being resistant to change however and this has been attributed as one of the main reasons for not implementing sustainable strategies (Yang *et al*., 2005). A growing body of literature evidences that certain attitudinal barriers preclude the implementation of sustainable construction practices (SCPs), namely attitudes towards cost, responsibility, understanding and issues regarding policy and legislation. These are discussed further at Chapter 2 section 2.4.

Higher Education Institutions (HEIs) as places of knowledge and research have a key role to play in relation to SD (Sedlacek, 2013). In its official SD strategy the UK Government have an on-going commitment to promoting education for sustainability (ESD), which asks educators "*to make sustainability literacy a core competency for professional graduates*" (HMG, 2005, p39). The UN also declared 2005-2015 the "Decade for Education for Sustainable Development" (UNESCO, 2003). Haigh (2005: p32) stated that the decade "*offers academics the best chance to date for making the deep and radical changes that will be necessary if the world's HEIs are to enact their responsibilities for creating a better and self-sustainable world*". Much has been written on the need to embed sustainability and SD into HE curricula (Murray and Murray, 2007) so that graduates on entering the construction industry are equipped with the skills and knowledge to adopt sustainable construction practices (SCPs) however, integration has been slow (Bossellmann, 2001; Everett, 2008; Rode and Michelsen, 2008) and is therefore not filtering into industry quickly enough if at all. It has long been recognised that

providing environmental education provides people with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to investigate issues, solve problems and protect and improve the environment (UNESCO, 1977), an opportunity which appears to be lacking at present within the construction industry. In addition, whilst HE has been used as a vehicle for promoting environmental change, attitudes of students in this area and that of SD are highly under researched (Kagawa 2007; Drayson *et al.,* 2012) and thus it is not yet evident if the sustainability education they are receiving is having an impact. Given the construction industry is responsible for 50% of all worldwide energy usage (a major contributor to climate change) and many of its practices have a detrimental impact on the environment, this is a matter which needs urgent attention.

Most environmental degradation and destruction is caused by human behaviour and as such, knowledge regarding what predisposes people to behave sustainably is required (Corral-Verdugo *et al.,* 2010). Psychology, the scientific field for the study of behaviour can provide us with such knowledge and may thus play an important role in the field of SD. A wealth of literature exists in relation to the environmental aspect within the domain of Environmental Psychology, however pertaining to SD it is a relatively young area of research but one which looks very promising for moving the sustainability agenda along. Indeed as Corral-Verdugo *et al.,* (2010: p7) state "*The elucidation of the psychological dimensions of sustainability is a primordial step in designing interventional strategies aimed at encouraging people to behave in accordance with sustainability principles*". This statement in fact underpins the very premise and aim of this research.

Given that attitudes are a major barrier to SD, ways of eliciting attitude change will be the focus of this research. As to how psychology may be useful in this respect, the literature indicates that emotional intelligence (EI) may be a useful construct in relation to sustainability and attitude change. Taylor (2007) for example in a review of the literature on emergent leaders who act as change agents to promote sustainable urban water management, found that sustainable urban water management champions are likely to have distinctive personality characteristics including high levels of EI. There is a growing body of literature (discussed in Chapter 3) which focuses on EI and leadership and which evidences that the most effective leaders are emotionally intelligent ones. Given the clear message from

Government that SD requires effective leadership, choosing leaders who are emotionally intelligent i.e. have high levels of emotional intelligence, may be the key to implementing and driving SD forward within the construction industry. Also, scholars tend to view EI as a factor which has the potential to contribute to more positive attitudes, behaviours and outcomes (Carmeli, 2003) making it an extremely worthwhile area of investigation for the current research. A new measure of EI, emotional self-efficacy (ESE) is the focus of this research as it not only measures EI, but also more importantly one's perceived self-efficacy in relation to one's EI abilities, as whilst a person may have high levels of EI, a lack of self-efficacy in this domain may prevent them from using this ability. This is discussed further in Chapter 3.

Another psychological construct that looks promising for attitude change is that of Optimism. A number of psychologists have documented the diverse benefits of optimism and drawbacks of pessimism (Peterson, 2000). Some authors (e.g. Doppelt, 2008) postulate that a positive orientation (optimism) is important for sustainability in that people are more likely to succeed in identifying ways of overcoming obstacles if they hold an optimistic orientation. Authors such as Corral-Verdugo and Pinheiro (2006), and Joreiman, *et al.,* (2001) have found that future-oriented individuals are also pro-environmentally oriented individuals. Perhaps more importantly, both these psychological constructs can be developed and this is the main factor for their inclusion within the research. An interdisciplinary approach is therefore adopted, investigating attitudes and whether these psychological constructs mediate the same.

Much emphasis has been placed on HEIs responsibility for achieving SD, however it is not the sole responsibility of HEIs and practices need to change in industry now. Indeed the barriers that exist to implementation exist within industry and thus seeking the counsel of industry as to how it perceives that SD can be best achieved may help provide direction as to where industry and academia need to head towards and also help foster a much needed collaborative relationship (Brennan and Cotgrave, 2014). Providing educational interventions informed through industry, accompanied by investigating psychological constructs, which the literature indicates may be helpful in understanding and changing the mind-set of a somewhat resistant industry, may be instrumental in moving the sustainability agenda along. Results yielded from the outcomes of this research could be important for embedding sustainability literacy in continuing professional development (CPD) and/or external/in-house training

programmes within industry and may benefit HEIs in that it may prove useful in informing sustainability curricula. Further, this research may also help foster the partnership between academia and industry in bringing together the theory and practice of SD, a topic which is undoubtedly of critical importance.

1.2 Research Problem

Attitudes towards SD are a major barrier to implementing SCPs in the construction industry. There is thus an imperative need to change such attitudes in order to move the sustainability agenda along. Previous work in this area (Cotgrave, 2008; Kokkarinen, 2011) has looked at the level of sustainability literacy in the curriculum and attempted to change student attitudes towards SD. These previous efforts have been unsuccessful in eliciting attitude change and thus other areas of investigation are warranted. In addition, given the greatest barriers to adoption of SD lie within industry, investigating whether such methods can be translated for use in industry is paramount.

1.2.1 Research Aims and Objectives

The overarching aim of this research is to propose an educational tool that may be used both within the construction industry and HE to promote more SCPs. The resulting tool should be of benefit to a broad range of practitioners working in the construction sector and higher education.

The tool in the form of an intervention will enable both students and professionals to question their values and beliefs pertaining to SD in the hope of changing attitudes and behaviour.

The overall aim will be achieved after the following objectives have been addressed:

1. Gain an understanding of SD within a construction context including the impacts of industry and the barriers and drivers towards the adoption of SCPs.

2. Identify current government and educational practices which promote SD.

3. Critically review and establish what psychological constructs might be useful in helping with attitude change.

4. Establish what measures exist for measuring attitudes towards SD in order to test whether any relationships exist between such attitudes and the psychological constructs identified

5. Conduct focus groups (FGs) with industry professions in order to assess areas for development to enable appropriate educational interventions to be created.

6. Develop interventions aimed at eliciting attitude change based on psychological principles of attitude change/formation and a review of methods of teaching and interventional techniques aimed at eliciting attitude change.

7. Test the usability of the intervention within industry via a FG.

1.2.2. Contribution to Knowledge

This research adopted a novel approach through the integration of knowledge from three separate disciplines: construction, psychology and education from which three contributions to original knowledge were made. The first was a solid contribution of the development of a measurement tool to measure attitudes towards SD which enabled psychological constructs to be tested against measures of attitudes towards SD. The measure's high reliabilities and the ability of the measure to elicit strong individual differences (demonstrated by good standard deviations from the mean) within the groups to whom the test was administered is an extremely important development as it will allow future research to assess which aspects of SD are favoured over others and those less favourable could be targets for increasing awareness, training and curriculum design. It will also allow for other psychological constructs to be tested to investigate whether other associations exist which may be useful for attitude and behaviour change. The second contribution was that through the testing of these constructs, it was established that ESE is a factor that is associated with more positive attitudes towards SD and thus should be considered in curricula design and professional development/training courses. Given the strong links between EI and leadership, ESE could

be an instrumental factor in driving the SD agenda along particularly as self-efficacy, a component of ESE, assumes that individuals can change their behaviours by changing their belief systems. The final contribution to knowledge of this research was the development of an educational intervention which was generated in the context of psychological theory, with reference to psychological principles and practice in order to target individual differences. Beliefs, emotions, values, motivation and cognitive processes were targeted to tap into the range of individual differences that are likely to impact on and consolidate attitude change. The intervention was successful in eliciting positive attitude change amongst students and has been validated by a group of consultants as suitable for use in industry but that in order for actual change to occur within this sector, it would need to form part of a wider programme over a longer period of time.

This work has also resulted in a number of publications which contribute to the literature in this area:

- Brennan, M. and Cotgrave, A.J. (2013). Investigating psychological variables as a means for attitude change towards sustainable development. *IPGRC 11th Annual Conference*, Salford, 8-10th April, 2013.

- Brennan, M. and Cotgrave, A.J. (2013). Development of a measure to assess attitudes towards sustainable development in the built environment: a pilot study. In: Smith, S.D and Ahiaga-Dagbui, D.D (eds.) *Proceedings of 29th Annual ARCOM Conference,* 2-4 September 2013, Reading, UK. Association of Researchers in Construction Management, 1265-1273.

- Brennan, M. and Cotgrave, A.J. (2014). Sustainable development: a qualitative inquiry into the current state of the UK construction industry. *Structural Survey*, 32(4), 315-330.

1.3 Methodology outline

1.3.1 Literature phase

In order to fully understand the research problem and the methods of addressing the same,

the initial methodology adopted was the undertaking of a thorough literature review, which focused on the following topics:

1. A review of sustainability and SD within a construction context and the relevant definitions pertaining thereto.

2. The impact of the construction industry.

3. The barriers and drivers in construction towards the adoption of SCPs.

4. Government and educational efforts to promote SD.

5. An overview of the psychological literature in relation to attitudes and what psychological constructs may help elicit attitude change.

6. An investigation into available measurement tools for SD attitudes.

7. A review of educational teaching methodologies and practices.

8. A review of the literature pertaining to interventions for attitude change.

The findings of the literature review have been used to formulate the research questions that needed to be answered. The main findings of each stage of the literature review are presented and summarised in each of their respective chapters.

1.3.2 Phase 1

Phase 1 of the research involved conducting a pilot study to assess attitudes towards SD amongst built environment students and whether the psychological constructs optimism and ESE mediate these attitudes followed by a replication study to validate the results. After consideration of the literature, it was identified that a number of instruments exist which measure environmental attitudes but that no validated instrument exists which measures attitudes towards the all three dimensions of SD. To address this issue, a measure to quantify

attitudes was developed. Once the measure was developed in order to test its validity and reliability it was piloted to 230 built environment students at LJMU along with the psychological measures. The development process and the piloting of the measure is described in Chapter 5. Initial analyses revealed the measure was valid and reliable and that the measure correlated with ESE but not optimism.

In order to further test the validity of the attitude measure and to generalize the findings of the pilot study a replication study was carried out. Given that optimism did not correlate with attitudes this was dropped from the replication study. 1000 attitude and ESE measures were sent out across 10 UK universities with a response rate of 184 (18.4%). Results again were statistically significant in that again ESE correlated positively with SD attitudes. Analysis and discussion of the findings are presented in Chapter 5.

Given that the barriers towards SD are prominent within the construction industry, the next step in this phase of the research was to obtain industry attitudes towards SD and to investigate whether the relationship with ESE was further generalizable to this population. The questionnaires were set up as on online survey and promoted through the use of social media platforms. It was hoped to receive 500 responses however despite the survey being on line for over a year and promoted throughout, only 83 responses were received (16% response rate). Other than the finding that there was a statistically positive correlation between ESE and the economic subscale of the measure, no other statistically significant results were found in this study. Unfortunately, given the amount of data obtained from the professional cohort, it was not possible to make any meaningful statistical comparisons with the student data.

1.3.3 Phase 2

Phase 2 involved conducting a number of FGs with industry professionals in order to ascertain an understanding of their perception of SD and how they think the SD agenda can be moved along, as well as informing the development of educational interventions. The outcomes of this are discussed in Chapter 6.

1.3.4 Phase 3

In phase 3, a review of the literature was undertaken pertaining to various teaching methodologies and interventions for attitude change to investigate what may be useful for the present research. The findings from both the quantitative and qualitative phases above were thoroughly reviewed again and used in conjunction with findings from the literature review to develop educational interventions (Chapter 7). The same were then piloted to 5 different student sets within the built environment at LJMU. The development, procedure and results of the interventions are discussed in Chapter 8.

1.3.5 Phase 4

The final phase of this research tested the usability of the intervention tool developed for use with industry professionals. A FG was conducted with a group of consultants who specialise in culture and behaviour change all of whom have worked in industry previously prior to becoming consultants. The researcher described the intervention tool and presented the findings of the intervention itself. A discussion then took place as to the feasibility and suitability of the tool for use with industry. The outcomes of this are discussed in Chapter 9.

1.3.6 Research methodologies

In addition to the review of the literature described above, a further literature review was undertaken to determine which research methodologies would be best suited for the purposes of this research. Alternative methodologies were evaluated to ensure that the most suitable methods were utilised to address the research problem. The method selected for the overall research was a concurrent embedded mixed method approach (Creswell and Plano Clark, 2011). Figure 1 below depicts each phase of the research and the correlating methodology adopted for the purpose of that phase.

Key:
White Box = Quantitative
Black Box = Qualitative
Grey Box =Quantitative/ Qualitative

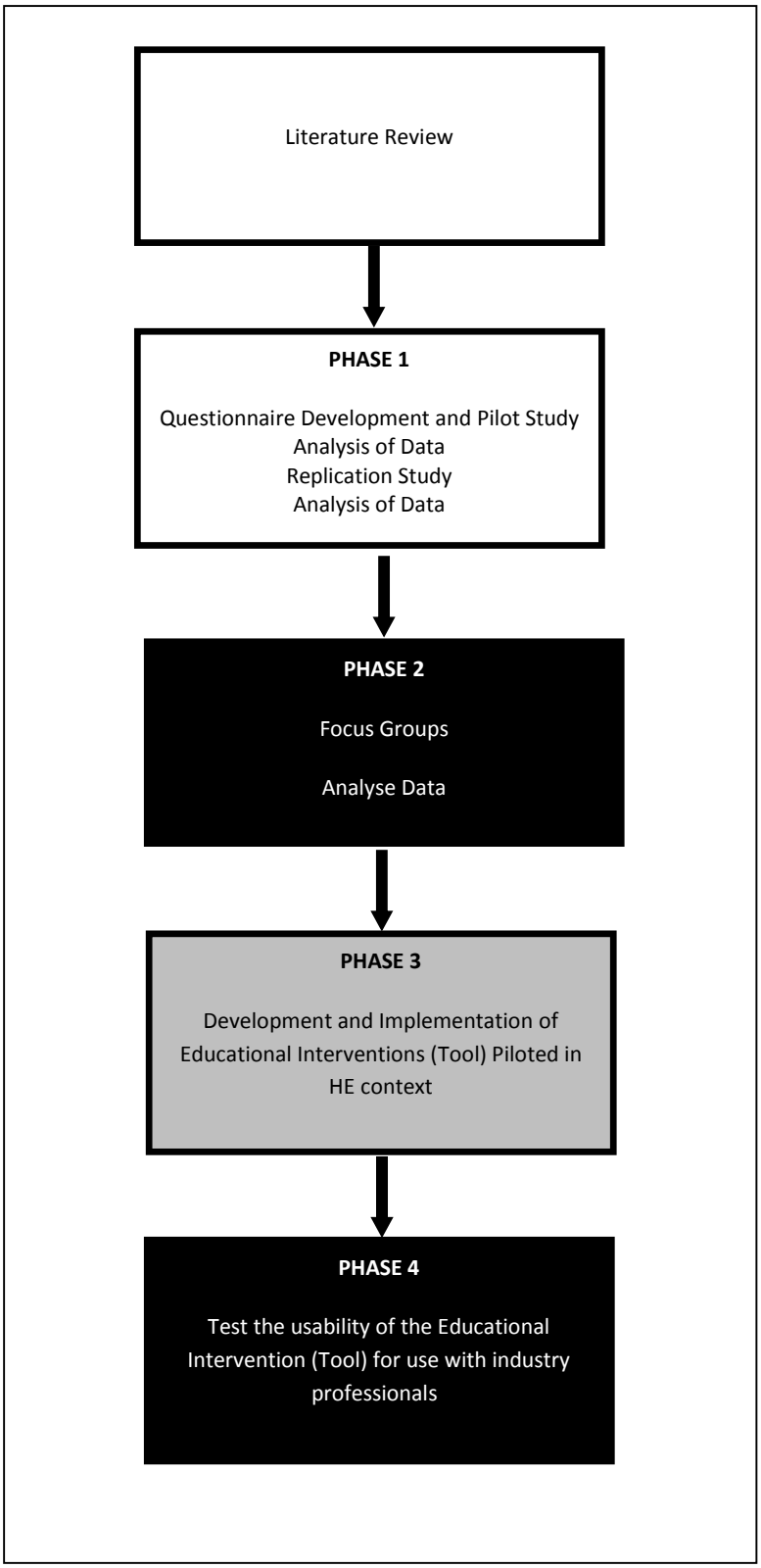


Figure 1. Overview of Research Methodology

1.4 Thesis Structure

The thesis consists of 10 chapters, a reference list and appendices.

Chapter 2 gives an overview of the various definitions of SD and the various issues and problems surrounding it in the context of the built environment. The three dimensions of SD are discussed in some detail before moving on to a review of the various Government initiatives pertaining to SD and what is being done in higher education to promote SD.

Chapter 3 reviews the psychological literature pertaining to attitudes, ESE and optimism and how these might be useful for changing attitudes towards SD.

Chapter 4 explores the various methodologies available for quantitative and qualitative research and presents the arguments for the various methods chosen for the current research. Summaries of the various methodologies used for each phase are provided also.

Chapter 5 pertains to phase 1 in which the development of a measure to quantify attitudes towards SD is discussed in detail along with the procedure and results from the subsequent pilot study which was conducted to investigate whether psychological variables correlated with the measure. Results from the further validation study are also provided. The methodology adopted for this phase, analyses and a brief conclusion of what can be inferred from the results are also included.

Chapter 6 discusses phase 2 with the procedure for conducting and analysing the FGs provided in detail. Findings from the pilot FG and the main FGs are then presented along with how these may be used to inform the development of the educational interventions in phase 3.

Chapter 7 refers in detail to the creation of the educational interventions. The rationale for choosing particular methods is discussed including how the findings from phases 3 and 4 feed into the development of the same.

Chapter 8 describes how the interventions were carried out, a detailed analysis of the results and a discussion of the main findings arising therefrom.

Chapter 9 discusses the testing of the intervention tool that was developed and piloted in Chapters 7 and 8 via a FG with industry professionals. Details of the FG procedure are provided and the outcomes of this in relation to the usability of the intervention in industry.

Chapter 10 discusses the research overall, highlighting the limitations of the research and offers recommendations for future work. Overall conclusions of the research are finally provided summing up the main findings and the contribution to knowledge.

1.5 Summary

This chapter provides the background, context and rationale for the present research. It also outlines the structure of the project detailing the methodologies to be used at each phase throughout the research in order to meet the aims and objectives set out herein. It also sets out how the outcomes of this research will make a contribution to knowledge:

- Well researched and applied curriculum interventions in sustainability accompanied by knowledge of psychological constructs, which the literature indicates may be helpful in understanding and changing the mind-set of a somewhat resistant industry, may be instrumental in moving the sustainability agenda along, may improve knowledge, and positively change attitudes and behaviour in construction professionals.

- Results yielded from the outcomes of the study could be important for embedding sustainability literacy and psychology principles in continuing professional development (CPD) and/or external/in-house training programmes within industry.

- HEIs may also benefit from the outcomes of this research in that it may prove useful in informing sustainability curricula.

- This research may also help foster the partnership between academia and industry in bringing together the theory and practice of SD a topic, which is undoubtedly of critical importance. The overall hypothesis tested in this research are as follows:

1. More positive attitudes towards sustainable development are associated with higher levels of emotional self-efficacy and optimism

2. The implementation of an educational intervention pertaining to aspects relevant for sustainability will elicit attitude change towards sustainable development

2. SD and the Construction Industry

Chapter 1 set the context for the research providing an overview of the background and the research problem highlighting the importance of the construction industry for SD. In order to determine what and if anything can be done to ameliorate the effects of construction activities, it was necessary to undertake an in-depth literature review to consider further the issues relevant to the overall aim of the research outlined in Chapter 1.

The objective of the literature review is to establish the following:-

1. Define SD in the context of construction and the implications of this in terms of how industry is not only responsible for environmental degradation and other adverse impacts, but also the ways in which industry can carry out its activities with minimal adverse impact.

2. Determine what the drivers and barriers are to the adoption of SCPs in order to highlight areas for intervention.

3. Investigate what is currently being done from a Governmental and educational perspective regarding SD.

2.1 Defining Sustainability

Sustainability is a widely used term with its meaning originally grounded in ecology referring to the potential of an ecosystem to subsist over time (Reboratti, 1999). Biologists and ecologists used the term to describe the rates at which renewable resources could be extracted or damaged by pollution without threatening the underlying integrity of ecosystems (Vos, 1997, cited in Vos 2007).

It is estimated that there are between 30 and 60 separate definitions of sustainability with little agreement as to its meaning in practical or even theoretical terms (Hartshorn *et al.,* 2005). What definition is used invariably depends on the individual in that it is generally influenced by one's training, one's working experience and one's political and economic

setting (Leal Filho, 2000). The many different actors involved in the construction process and the fact that priorities and needs vary within and between countries have made it even more challenging to define sustainability and very difficult to pin down a global definition of sustainability. As such, sustainability has found its way into many phrases across a variety of contexts, including that of 'sustainable development', 'sustainable societies', 'sustainable communities', 'ecological sustainability', 'sustainable growth', and 'strategic sustainability' (Vos, 2007).

Some rather simplistic views of sustainability have been proffered such as "*sustainability implies that the long-term use of the ecosystem is maximised to the intensity where the resource base, structure or function of the ecosystem is not degraded or adversely changed*" Sverdrup and Rosen (1998) and the "*basic idea of sustainability is quite straightforward: a sustainable system is one which survives or persists*", Costanza and Patten (1995, p. 193) whereas others such as Raynsford have attempted to provide a more wider definition for sustainability by including themes such as 'social progress', 'prudent use of natural resources', 'environmental protection' and 'economic growth through stable levels of employment'. Whatever definition one assumes, the basic premise of sustainability appears to be how sustaining the well-being of living systems can be achieved over time (Atkinson, 2008).

Terms associated with sustainability such as continuing, enduring (Murray and Cotgrave, 2007) and constant, translated in some languages (e.g. French, Dutch and Romanian) as durable (CIB, 1999) have given rise to confusion in its applicability to construction as some materials used in construction by definition are in conflict with such terms. Concrete for example, as Cotgrave, (2008) points out, whilst hardwearing and lasts a long time (durable) is not sustainable. It has therefore been necessary to try and define sustainability in the context of construction. For the purposes of the current research, the definitions that are required are that of sustainable development and sustainable construction, both of which are subsets of sustainability (Cotgrave, 2008).

2.2 Defining Sustainable Development

The concept of 'SD' grew from the concern that the world population's consumption of resources and production of waste could exceed the earth's capacity to produce these

resources and absorb waste. Such concerns are not unfounded as a recent report from the New Economics Foundation found that if everyone in the world consumed resources at the same rate as people in the UK, we would need over three planets to sustain us. Further, if everyone in the world consumed at the same rate as the US average, over five planets would be required (Chong *et al.,* 2006).

Again, like sustainability, despite numerous attempts to define SD, its concept and meaning remain ambiguous. The convergence of many constituencies and the development of many initiatives around sustainability have led to a wide diversity of perspectives generating numerous definitions, conceptualisations and frameworks of sustainability (Carpenter and Vanegas, 1998 cited in Vanegas, 2003). Mansfield (2009) states that the difficulties of defining SD are further compounded when specifically applied to the built environment with the term becoming kaleidoscopic as it encompasses issues including large-scale planning, development control, the design of property and infrastructure, the procurement of materials and components, the construction processes, and the operation, management and maintenance of the facilities once constructed. To further complicate matters, a myriad of terms are frequently and interchangeably used in the research, policy and practitioner literature pertaining to SD including, for example, sustainable architecture, sustainable building, sustainable design, sustainable real estate and green building. Whilst this flexibility has meant almost universal adoption, it has also lead to confusion and made implementation more challenging (Drexhage and Murphy, 2010).

Atkinson (2008), states that despite this lack of consensus however, there is some coherency about what SD is which stems from a common concern about the way in which the benefits of development are shared across generations and which can be defined in relatively succinct terms. Murray (2011) states that *"If sustainability is the aspiration to create a sustainable future then SD is the action by which that aspiration is reached"*. The most widely adopted and cited definition of SD from the Brundtland Report from the World Commission on Environment and Development (WCED) provides such a succinct definition of SD: "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED, 1987).

Since the Brundtland report and subsequent definition, the concept of SD has evolved significantly from that of 'being green' and reducing the consumption of natural resources and recycling (Yang *et al.,* 2005). Today, it is generally accepted that SD incorporates three central tenets: social, economic and environmental, also commonly referred to as the three pillars of SD. It is important to understand each of the three tenets of SD in order to try and place it in the context of construction. Each of the tenets is discussed in more detail at sections 2.2.1, 2.2.2 and 2.2.3.

It is also perhaps prudent at this point to distinguish between green building and SD as the above definition encompasses both. Kibert (2013: p8) defines green buildings as "*healthy facilities designed and built in a resource efficient manner using ecologically based principles".* Thus green building is distinct from SD in that it refers to the components of the building whereas SD is concerned with a wider range of outcomes that can result from construction activities and these are discussed in more detail below within the context of the three pillars of SD.

Other forms of sustainability have been articulated elsewhere in the literature, such as political, technical and cultural amongst others. However within the construction industry, the triple bottom line remains the dominant model and thus for the purposes of the present research, sustainability is confined to the social, economic and environmental aspects. Indeed, according to Sourani and Sohail (2011: p229), sustainability in the context of construction is "*about achieving a balance between the social, economic and environmental aspects of construction so that the costs and the benefits, evaluated along these three dimensions, are optimised*".

Each of the dimensions is now discussed in turn followed by a discussion on the holistic approach to SD at section 2.2.4.

2.2.1 The Environmental Dimension

The environmental dimension of SD incorporates issues such as:

- Ecology
- Nature
- Resources
- Life
- Biodiversity

Ekins *et al.* (2003: p173) define environmental sustainability as "*the maintenance of important environmental functions and therefore, the maintenance of the capacity of the capital stock to provide those functions*".

The last few centuries have seen the environment viewed as external to humanity, with its resources used and exploited and the relationship between people and the environment largely conceived as humanity's triumph over nature (Hopwood *et al.,* 2005). The Industrial Revolution lead to the design of products and manufacturing systems, which lead to growth and prosperity, however yielded a multitude of unintended yet devastating consequences for future generations (Braungart and McDonough, 2009). Since the industrial revolution for example, CO2 levels have been steadily increasing due to our reliance on fossil fuels for energy (Conard, 2013). The philosophy of environmental sustainability is to leave the earth in a state that will be sufficient or better for future generations and thus as Khalfan, (2002) states, only when human activities stop depleting natural resources and degrading the environment can the environment be sustainable.

Many ecosystems, especially those used for the built environment, have multifunctionality of their resources, forests which provide homes to many species, we cut down for furniture and paper leading to loss of habitats. Any loss in biodiversity is definite. Once an ecosystem has been destroyed, there is no reversing it. Such declines in biodiversity have led to the loss of whole cultures. It is believed that the Mayan culture collapsed (largely in part) due to myopic thinking and failure to acknowledge the warning of depleted soils, silted lakes and declining

water supplies (Doppelt, 2008) an oversight we cannot afford now if we are to ensure the survival of our planet. The loss of biodiversity has been identified as one of the most serious global environmental changes threatening the biosphere (Wilson, 2001) making it a focus of scientific research and political action at the international and intergovernmental level during the last few decades (Corral-Verdugo *et al.,* 2009). Just how important this aspect of sustainability is was emphasised at the 1992 Rio Conference when a specific convention for the conservation of biodiversity was signed by all UN countries. Even the aesthetics of the BUE have been criticised for degrading the environment. Design approaches to development have tended to overwhelm and ignore natural and cultural diversity rather than being designed around local landscapes, which has led to the urban environment being described by some as "…*like a cancer spreading more and more, eradicating the living environment and blanketing the natural landscape with layers of asphalt and concrete*" (Braungart and McDonough, 2009: p33).

Whilst in the past resource use and waste was seen as a means to lift humanity out of poverty and into prosperity, the Brundtland report brought all of the above into sharp reality. It is now understood that the Promethean view (Dryzek, 1997) that human knowledge and technology could overcome all obstacles including natural and environmental ones, is no longer sustainable and that technology cannot alone not save us. While it is possible that future generations will find ways to substitute some natural resources through technical innovations, there are certain environmental aspects that cannot be substituted such as the ozone layer, which provides critical protection to human existence. Ecological sustainability research has thus become based on the realisation that on a finite earth, the depreciation of natural capital cannot go on endlessly (Lovins *et al*., 1999). If we continue to consume more energy and materials than can be reproduced or emit more emissions than can be absorbed through natural sinks, the industrial system will become ecologically unsustainable (Ayres, 1995: p4). Without resources from the environment, humanity cannot survive thus the degradation and emptying of resources will ultimately lead to the extinction of the human race. It is inevitable that the built environment will continue to develop, however it must be done in a way that does not compromise the planet to sustain itself now and in the future. The construction industry uses an inordinate amount of energy and resources (discussed in

detail at section 2.4) and it is imperative that the way that construction activities are undertaken is revised.

The UK Government has set ambitious targets in its latest strategy Construction 2025 (BIS, 2013), which includes a 50% reduction in greenhouse gases emission in the built environment. Moving towards the 50% reduction target in the strategy in addition to the longer term targets of the Climate Change Act (2008) will require serious efforts from industry in order to meet this target and the others set out in the strategy which are discussed in more detail in section 2.6.

2.2.2 The Social Dimension

The social dimension of sustainability embodies issues such as:

- Justice/equity
- Poverty
- Social investment (education)
- Creating Safe Communities

Colantonio and Dixon (2009) from the Oxford Institute for SD (OISD) define social sustainability as:

"*Concerning how individuals, communities and societies live with each other and set out to achieve the objectives of development models which they have chosen for themselves, also taking into account the physical boundaries of their places and planet earth as a whole. At a more operational level, social sustainability stems from actions in key thematic areas, encompassing the social realm of individuals and societies, which ranges from capacity building and skills development to environmental and spatial inequalities. In this sense, social sustainability blends traditional social policy areas and principles, such as equity and health, with emerging issues concerning participation, needs, social capital, the economy, the environment, and more recently, with the notions of happiness, wellbeing and quality of life*".

Of all the aspects of the social dimension, poverty is perhaps the most important. Poverty affects and harms a multitude of people through malnourishment, inadequate healthcare, educational hardships, poor housing, unemployment and pollution (Raynsford, 1999). Worryingly, according to the United Nations Development Programme human poverty index, more than 2.2 billion people are either near or living in poverty (UNDP, 2014). With global population on the rise, estimated to be 9 billion by 2050 (UN, 2012) grave efforts are needed to combat the same. Given environmental damage from global consumption impacts greatest on the poorest countries, there is a tendency to link poverty with the developing world. The problem however is far more widespread than that. It is a global problem affecting many countries including the UK. One only needs to look at the number of homeless people that occupy the streets of cities to find evidence of this. A report, by the Institute for Public Policy Research (IPPR, 2004), showed that in 2000, children in Britain were more likely to be born into poverty than anywhere else in the European Union with nearly one-third of all children in the United Kingdom living below the breadline compared with 13 per cent in Germany, 12 per cent in France and 24 per cent in Italy. The Organisation of Economic Co-operation and Development (OECD, 2008) found that children and young adults have poverty rates that are now around 25% higher than the population average while they were close to or below that 20 years ago with UK child poverty doubling since 1979.

The UN stated that poverty is the *"greatest threat to political stability, social cohesion and the environmental health of the planet*" (UNDP, 1994: p20) and that "*Eradicating poverty is the greatest global challenge facing the world today and an indispensable requirement for SD. In this regard we are committed to freeing humanity from poverty and hunger as a matter of urgency*" (UN, 2012: p1). Statements such as these and stark clear warnings from international organisations such as the World Council for SD (WCSD) have placed the reduction of poverty as a primary objective of SD (Torjman, 2000).

Despite such statements from the UN and the WCSD, unfortunately the status quo remains in relation to poverty with attempts to alleviate poverty and inequality virtually none-existent (Dyllick and Hockerts, 2002). The 2012 Earth Summit in Rio however again brought such issues to the forefront of the agenda, emphasising just how important this aspect of SD is. For Brundtland there is a strong relationship between poverty and SD because poverty is a

major cause of environmental degradation/deterioration, "*those who are poor and hungry will often destroy their immediate environment in order to survive*" (WCSD, 1987: 28) thus the reduction of poverty is a necessity for environmental SD.

The eradication, or perhaps at best, the reduction of poverty through SD can increase the health and wellbeing of populations and can create economic prosperity. Vice versa, a vibrant economy further increases the health and wellbeing of humanity thus strengthening the social dimension of SD. This is further eluded to below at section 2.3 in how taking a holistic approach can achieve aims such as these.

Turning to social investment, this links directly to the definition of sustainability postulated by Brundtland – meeting the needs of the present without compromising the ability of future generations to meet their own needs. By investing in today's generation, we will ensure that future generations are protected. A primary form of social investment is that of education, with education and skills development essential to the economic health of individuals and of nations.

Reports by the World Commission (WCED, 1987) and the UN (UN, 1994), emphasise the need to improve the status and education of women in particular as the principal route to poverty reduction and environmental protection. Poverty and discrimination against women has become more severe since 1987 (Baumgartner, 2011). In a developing world, this should be declining, not increasing. Women have a vital role to play in the SD agenda. The UN at the 2012 earth summit emphasised the need to empower women in order to move the agenda along. It is worth nothing that such worries were highlighted nearly 2 decades ago as stated above. The same rhetoric reiterated again at the 2012 summit demonstrates that the status quo remains and that urgent action is required. The argument for educating women is further substantiated by research which shows that improvements in the social, political and education status of women in society tends to lead to a reduction in birth rate and a slowdown in population growth (Baker, 2007). The Brundtland report set out that an aim of sustainability should be to reduce population growth to sustainable levels and stabilise population size relative to available resources (Baker 2007: p23). The evidence clearly shows that educating women can help to achieve this objective.

The association between poverty, health, lower education and income is a longstanding issue. A wealth of literature provides evidence that higher levels of education are associated with higher incomes, better health and longevity of life (Barth, 2003; Riddell, 2004; CDC, 2011). Further, recent research indicates that education is more important than genetic predisposition, race, or any other factor in predicting longevity of life. This means that a well-educated person coming from a poor family has better prospects for a longer, healthier life than an uneducated rich person. Importantly, studies such as Pe'er, Goldman and Yavetz (2007) have found significant relationships between mothers' level of education and environmental knowledge of students indicating that higher levels of education can also lead to more environmental awareness of children. In addition, the WBCSD (2007) reported that environmental attitudes are linked with social levels in that as level of education increases so does energy saving behaviour.

Social investment in the form of job provision is an important factor for sustainability. Local job creation could bring wide-ranging opportunities in the environmental field, such as energy efficiency upgrades and recycling (Torjman, 2000). Doppelt (2008) provides examples of initiatives in the US that are driving forward the creation of jobs in such fields such as the Green Collar Jobs Programme, which designated US$250,000 in 2007 to train unemployed people in solar and green installation and Richmond, California, which is spending US$1 million annually to train low income residents in solar power installation as a way of preparing them for jobs in the solar industry. Molnar *et al.* (2011) report on a project in New York, (The Block by Block Project) which in addition to working towards moving sustainability agendas forward by building weatherisation and retrofitting for efficiency initiatives, also aims to increase employment opportunities in these fields for low to middle income residents within the targeted community. Such projects evidence how SD can contribute on a social and economic level. Given the breadth and scope of the construction industry, the opportunities for local job creation are potentially great.

Community involvement, another factor of the social dimension, has been shown to promote sustainability. A study by Khan and Bajracharya (2005) which looked at the impact of Agenda 21, a policy plan for SD in the 21st Century, on local communities found that a perceived

stronger community support to maintain the rural character and life-style seems to motivate the council to protect the natural environment and promote sustainability. At a local level, if all communities engaged in community support, relevant to their local needs and priorities, then much could be done to move the agenda along. In respect of the construction industry, engaging the community in projects, given they are stakeholders, may help to embrace this sense of community. The creation of sustainable buildings and communities has clear benefits through improved wellbeing, reduced crime and community cohesion (Constructing Excellence, 2013).

Despite the anthropocentric focus of the definition of sustainability (Hopwood *et al.*, 2005), and the fact that at the heart of many definitions the emphasis is on the promotion of and sustaining of wellbeing (Atkinson, 2008), little attention is given to the social dimension of sustainability in built environment disciplines (Dempsey, 2011). Again perhaps this is due to the differences of opinion on the definition of sustainability, and indeed many minimise the importance of the social aspects in the developed world (Torjman, 2000). Proponents of the social dimension however such as Vanegas (2003: p5364) go as far as to state that "*First and foremost, built environment sustainability is about people; it is about continuously enabling, maintaining and enhancing the quality of life of people within families, communities, organisations and society*". Larsen (2009), further states that people are the facilitators, benefactors and sufferers of developmental activities, which should lead to this area being heavily focused on.

The literature demonstrates just how little importance is attached to the social dimension within the construction industry. A study by Cooper *et al.,* (2005) reported what 145 construction firms saw as the key external and internal drivers provoking the adoption of sustainable practices. Many of the drivers cited such as reducing risk, cutting waste, and keeping up with competitors, address only the economic and environmental dimensions of sustainability. Indeed drivers associated with social sustainability (e.g. empowering staff, fostering community relations) ranked lowest. In the same study, it was identified that those who address all three dimensions are more likely to progress and have a greater profile than those who just focus on the economic and environmental dimensions indicating that

incorporating the social dimension may be vitally important for driving the sustainability agenda along, an opportunity that many are missing out on.

Halliday (2008: p4) states that "*it is unsurprising that the social dimension is not considered in SD as the values of equity and interdependence have not been integrated into education and training and are difficult to translate into the pragmatics of daily practice of building design and costs professionals…".* The literature discussed above in relation to the social dimension of SD emphasises just how important this aspect is. The need for this to be communicated across both HE and industry is paramount.

2.2.3 The Economic Dimension

The economic dimension of sustainability embodies issues such as:

- Growth
- Trade
- Profit
- Corporate interest

Today the economy dominates both the environment and society (Giddings *et al.,* 2002) with today's industrial infrastructure designed to chase economic growth but doing so at the expense of human and ecological health (Braungart and McDonough, 2009). There is no question that in order to survive businesses have to be profitable, however it is how these profits are made that matters in relation to sustainability (Murray, 2011). In the past, firms have focused more on short-term gains concentrating and reporting quarterly figures rather than looking at what they can achieve in the long term thus providing for now without consideration for future generations which is not in line with sustainable thinking (Dyllick and Hockerts 2002).

Growth however has been the most important policy goal across the world for the last five decades and is the reason why it has been difficult to find a balance between sustainability and the economic growth of countries. Previously it was thought that by increasing growth in developed countries, there would be a trickle-down effect to developing countries. For

example in Britain and internationally, inequality in wealth, power and education is often justified on the grounds that it will aid economic growth which in turn will raise everyone's living standards. This trickle-down theory of growth however had the adverse effect of creating greater divides between society with increased not reduced inequality suffered by the poor (Giddings, Hopwood and O'Brien, 2002).

The recent financial and economic crisis has meant that it has become increasingly hard, and in particular for the construction industry, for SD to be integrated into business thinking. Exemplar projects and evidence from other business demonstrate however that the adoption of sustainable practices can lead to greater profits. Whilst initial investment/expenditure may be greater, returns can also be greater in the long run.

The economic dimension of sustainability posits that we need to look at the bigger picture and possible long-term returns. To ensure a future for future generations, we must invest in the technology and knowledge that although perhaps more costly in the first instance, will provide greater long-term returns. Through the integration of sustainable methods such as life-cycle costing and Building Information Modelling (BIM) savings, waste reduction and sustainability can all be achieved.

2.2.4 A Holistic Approach to Sustainability

While there has been extensive work on all three dimensions of sustainability over the past few decades, the 1992 Earth Summit in Rio brought into widespread acceptance of many stakeholders that none of the problems associated with one dimension can be solved without also solving those associated with the other two (Keating, 1993) and thus all need to be addressed at the same time (Forum for the Future, 2004). However debates about SD have usually given either the environment or the economy priority. The economy is often given priority in policies where the environment is viewed as apart from humans with any issues pertaining to the society often marginalised with the wider social issues often falling off the sustainability agenda with this separation of environment, society and the economy often leading to narrow techno-scientific approaches to SD (Giddings, Hopwood and O'Brien, 2002). Pappas (2012) also points out that the limited scope of focusing on one aspect over another,

neglects the fact that sustainability must be considered a system of interdependent factors, and that a change in one factor is likely to result in an unpredictable change in other factors.

From a social perspective in particular, human well-being cannot be sustained without a healthy environment or in the absence of a vibrant economy (Torjman, 2000). The potential of the built environment to increase the productivity of employees has clear economic benefits (Constructing Excellence, 2013). The economy is dependent on society and the environment while human existence and society are dependent on and within the environment (Giddings, Hopwood and O'Brien, 2002). Many people especially the poor, depend on the environment and the ecosystems within for their livelihood, economic, social and physical wellbeing (UN, 2012). Degradation of the environment and ecosystems means that people are unable to provide for themselves. It is the poor in developing countries that are hit the hardest, in particular from actions conducted in the built environment in the developed world. Resource depletion, desertification, deforestation, overfishing, water scarcity and loss of biodiversity results in competition for what resources are available placing further pressure on the environment**.**

Most now recognise that all three dimensions of sustainability are interconnected and that a holistic approach needs to be taken to achieve full and true SD. The construction industry influences all three dimensions of sustainability and therefore has a major role to play in moving the agenda along.

The UK Government has set its own SD agenda and recognising the construction industry's ability to contribute to SD, has published a number of reports and implemented several initiatives encouraging reform in the industry (DEFRA, 2002; Wolstenholme *et al*., 2009, HM Government, 2005; HM Government, 2008; Cabinet Office, 2011; BIS, 2013). The Government considers SC as a set of processes by which a profitable and competitive industry delivers built assets which:

- Enhance quality of life and offer customer satisfaction
- Offer flexibility and the potential to cater for user changes in the future
- Provide and support desirable natural and social environments and

- Maximise the efficient use of resources

The recent Wolstenholme report 'Never Waste a Good Crisis' (Wolstenholme *et al.,* 2009: p8) which followed up progress since the Egan report however stated that " *people often pay lip service to the Egan agenda and fail to engage in the true spirit of the report. Instead they cherry pick the behaviours they wish to adopt, based on their own self-interest*". We now need to move from the rhetoric that SD involves environmental, economical and social aspects and start actively making and demonstrating the links between each dimension (Halliday, 2008) and seek out opportunities which enhance rather than continually degrade the social and natural environment (Murray, 2011).

The holistic approach to SD has been depicted through the use of a number of models to illustrate the three dimensions and how they impact upon each other:

1. The Venn Diagram Model (Figure 2)
2. The Concentric Circles Model (Figure 3)
3. The Three Pillars Model - also known as the triple bottom line - people, planet, profit (Figure 4)

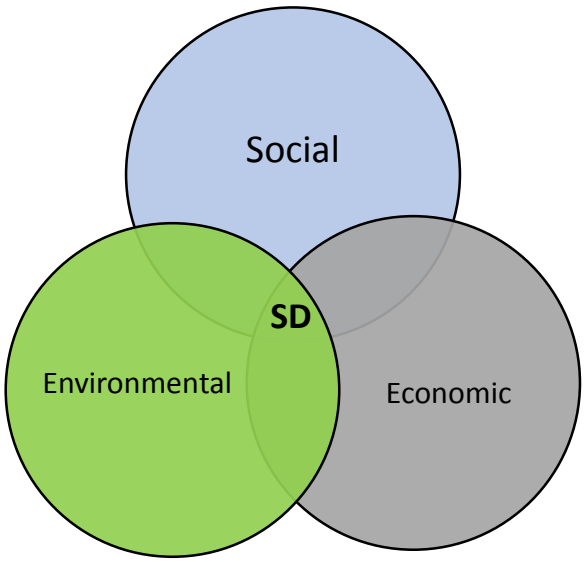


Figure 2. Venn diagram model of sustainable development (adapted from Cotgrave and Riley, 2013)

The Venn diagram represents interaction between the three domains which would lead to sustainability demonstrating that all three dimensions need to be considered equally in order to achieve a sustainable development. Any imbalance between the three dimensions will reduce sustainability.

Figure 3. Concentric circles model of sustainable development (adapted from Cotgrave and Riley, 2013)

The concentric circles model of SD emphasises the importance of the environment. It demonstrates that the social and economic dimensions must support nature for the system to continue. Whilst the environmental circle is the largest, this does not mean that this is the most important, but that this is perhaps what we should start with (Cotgrave, 2013) as if the health of the environment is compromised, everything else is undermined (Baker, 2007). Thus by protecting the environment, we protect society and the economy. For example a healthy environment is needed for the provision of healthcare services (Torjman, 2000) which in turn provides for a healthy society ensuring people are fit and well to work thus impacting on the economic sector.

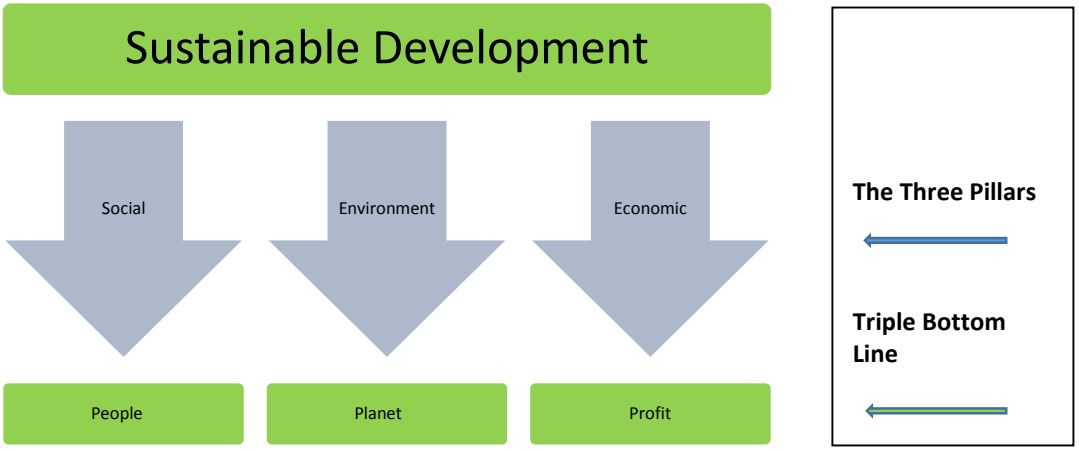


Figure 4. The three pillars of sustainability and the triple bottom line (adapted from Cotgrave and Riley, 2013)

Figure 4 illustrates the concept of sustainability using the three pillars model. It also shows how this links to the triple bottom line view of sustainability. The three pillars model has been the most useful in helping to understand the link between sustainability and construction. It reflects the other two models but demonstrates how sustainability can be achieved whilst still achieving profit which is crucial if organisations, including construction and property companies, are going to buy in to sustainability (Cotgrave, 2013).

Whilst the models depict sustainability from different viewpoints, what all of these models demonstrate is that sustainability should and needs to be approached from a holistic viewpoint. As figure 2 depicts, true SD only occurs when all three tenets come together.

2.3 Defining Sustainable Construction

The construction industry has been defined as "*all who produce, develop, plan, design, build, alter, or maintain the built environment, and includes building material suppliers and manufacturers as well as clients, end users and occupiers*" (Khalfan, 2002: p15). The term sustainable construction (SC) is a subset of SD, which is used to describe the application of SD to the construction industry by the above parties to addresses the ecological, social and economic issues of a building in the context of its community and the role of the BUE in contributing to the overarching vision of SD (Kibert, 2013).

The term was first formally defined by the CIB in 1994 as "…*creating and operating a healthy built environment based on resource efficiency and ecological principles*". Du Plessis (2002) later defined SC as "*a holistic process in which the principles of sustainable development are applied to the comprehensive construction cycle, from the extraction and beneficiation of raw materials, through the planning, design, and construction of buildings and infrastructure, until their possible final deconstruction, and management of the resultant waste"*.

A more recent definition incorporating SC as a business strategy is offered by Tan, Shen and Yao (2011: p227) who define SC as "*The integration of environmental, social and economic considerations into construction business strategies and practices. It is the application of the principles of sustainable development to the comprehensive construction cycle from the extraction of raw materials, through the planning, design and construction of buildings and infrastructure, until their final deconstruction and management of the resultant waste".*

The construction industry contributes enormously to all three areas of SD as discussed above as it affects all aspects of human activity from our working life, our social life right down to our health and wellbeing, and has the potential to create extremely positive impacts through its practices. To understand where industry needs to adapt and change its practices, it is first necessary to understand where industry has the greatest impacts. The various ways industry impacts on SD are discussed below.

2.4 Impact of the Construction Industry

According to a report by the UN in 2008 (UNISDR, 2008), between 1991 and 2005, 3,470 million people were affected by climate induced disasters, 960,000 people died, and economic losses amounted to over 1 billion US dollars, with poor countries disproportionately affected relative to their population size and GDP. Pollution of ecosystems from building works and from other human activities has devastating effects on our planet, not only to the planet but also to humanity itself. Research conducted by Pimentel *et al.* (2007) found that approximately 40% of deaths worldwide are caused by water, air and soil pollution. It is also estimated that by 2050, if greenhouse emissions continue at their present rate, 15-37% of all animals and plants will be threatened with extinction (Thomas *et al*., 2004). Whilst industry is not solely responsible and cannot alleviate climate change and associated impacts solely

either, it is unparalleled compared to other sectors given the scale of its contribution to such impacts.

2.4.1 Resource Consumption

Through both construction and use, the built environment consumes an inordinate quantity of resources reducing environmental wealth (CIB, 1999; Langston and Dingk, 2001). The extraction of raw materials from the earth contributes to a loss of biodiversity and destroys natural habitats. Large portions of forests are cleared each year, resulting in the extinction of 20,000 species a year (Edwards, 2002) with the creation of timber products for use in the construction sector responsible for most of this loss (Ampotho-Anti, 2009).

The depletion and use of natural resources is causing catastrophic damage to our planet at an alarming rate. The industrial world consumes way beyond its basic needs threatening the planet's resource base, eco and bio systems (Baker, 2007). Today's society consumes large parts of the earth's natural capital however the bulk of the damage is likely to be borne by future generations (Dyllick and Hockerts, 2002) thus the development model that we have used since the industrial revolution is no longer viable. Continuing on such a path places burdens on the planet that will continue to escalate until we are no longer able to sustain and support ourselves (Murray 2011).

Consumption of materials can be abated through recycling and reuse which Anastas and Zimmerman (2003: p96) state should be done during the design stage, emphasising the importance of sustainable design and its impact over the life of a building:

> *'Sustainable design should encourage reuse and recycling: Products, processes, and systems should be designed for sustainable performance in a commercial 'afterlife".*

This is particularly important given that the population is on the increase. As the population increases, so does housing demand and thus demands on materials. More buildings mean more energy use (WBCSD, 2007). The re-use and recycling of building components and materials can be applied either during or after (or both) a building's lifecycle. The practical, environmental, social and economic aspects of using reclaimed components however are

often not properly understood in the construction industry (Gorgolewski and Ergun, 2013). Designers who have attempted to integrate reclaimed components in the design of permanent buildings state that using reclaimed materials adds a whole new level of complexity to the project (Chapman and Simmonds, 2000, cited in Gorgolewski, 2008).

The reuse and recycling of materials in buildings can contribute significantly to the environmental, economic and social dimensions of sustainability (Gorgolewski, 2008). The use of recycled materials at any stage displaces requirements for new materials and may save considerable cost, natural energy and embodied energy (Adeyeye *et al.,* 2006). Studies by Janssen and Henriks (2002) demonstrate how using recycled and natural building materials in projects wherever possible given their low level of incorporated energy, can help to reduce the environmental impact of resource consumption.

End of life activities such as the use of demolition equipment and transporting of waste to landfill also contribute to the environmental impacts of built environments, (Junnila *et al*., 2006). Designing buildings that are recyclable will negate such processes further reducing the environmental footprint of the industry as recycling and reusing materials for new or retrofitting old dwellings will clearly have less of an impact on the environment and be more cost-effective. As to what constitutes for 'green materials' however and the nomenclature attached to the same makes the subject just as ambiguous as 'SD' with a universal definition yet to be conceded (Kubba, 2010; cited in Franzoni, 2011). What is important however is that we start to think about how to design and construct buildings sustainably and in line with the ever changing environment.

2.4.2 Energy

The BUE is responsible for 50 per cent of the total UK energy consumption; 45 per cent to heat, light and ventilate buildings and 5 per cent to construct them (Edwards, 2002). Under the Climate Change Act of 2008, the UK is committed to reducing greenhouse gas emissions by 80% by 2050 (DCLG, 2007). Whilst efforts are being made to reduce energy consumption, some such as the Royal Institution of Chartered Surveyors (RICS) state they believe that the government is failing in its energy policy to make enough difference (Pitt *et al*, 2009). Thus a

more concerted effort is needed by both government and industry. Much of the energy consumed by the industry is through embodied energy and post use consumption of energy.

2.4.2.1 Embodied energy

Embodied energy represents the energy consumed in materials' extraction, production and delivery to the construction-site (Franzoni, 2011). In simple terms "*a building embodies the sum of the energy used to make all of its components plus the energy expended in its construction. This includes energy consumed by all of the processes associated with the production of a building, from the acquisition of natural resources to product delivery, including mining, manufacturing of materials and equipment and the transport of the materials to site*" (Mansfield, 2009: p281). In addition, each of these components has environmental costs. For example, the transport involved in the processing, packaging and installation of components and materials can be highly polluting depending on weight and distance from site and the procurement of raw materials, such as harvesting trees and extracting mineral resources including iron ore, bauxite and limestone, can irreparably disturb the natural environment (Pearce, 2004, cited in Mansfield, 2009). Even on-site processes of construction have environmental impacts. A study by Gangolells *et al.,* (2009) found that found that the generation of greenhouse gas emissions due to construction machinery and the movements of vehicles on a building project had an extremely significant impact.

Embodied energy contained within any building is considerable and the longer the building's lifespan, the greater the investment in embodied energy will be. Typically buildings in the UK have a lifespan of 50 years. Given that embodied energy accounts for 2-38% of the overall energy consumed over the 50-years building's lifetime in conventional buildings and for 9-46% in low energy consumption buildings (Bribian *et al*., 2011) the importance of selecting sustainable building materials in the design process is great.

Several authors (Sandrolini and Franzoni, 2010; Dixit *et al.,* 2010; Ramesh *et al.,* 2010) proffer that embodied energy should also include the 'recurrent' embodied energy used in the maintenance and refurbishing processes of building materials and components, and the demolition energy necessary for deconstruction of buildings and disposing of materials. Waters *et al*., (2007; cited in Mansfield 2009) state that demolition of existing stock due to

perceived poor environmental performance, non-compliance with modern Building Regulations or the absence of demand for ownership/occupation destroys embodied energy. This is a waste of energy and if it can be recycled we will be saving energy reiterating the importance of recycling materials.

2.4.2.2 Post Build Energy

Post build, heating, lighting, hot water and air conditioning are the greatest users of energy. The WBCSD (2007) state that energy consumption in buildings will continue to grow dramatically if no action is taken and thus to reduce carbon dioxide emissions from energy, substantial reductions are needed both in energy generation and consumption. The Intergovernmental Panel on Climate Change (cited in WBCSD, 2007) state that opportunities for reducing energy consumption and GHG in the building sector exist worldwide. Some of the practices currently in existence to be used are:

- Efficient lighting and day lighting;
- More efficient electrical appliances and heating and cooling devices;
- Improved insulation;
- Passive and active solar design for heating and cooling;
- Recovery and recycling of fluorinated gases.

Environmentally sound technologies, such as biomass heating systems, photovoltaics converting light energy to electricity, solar thermal receptors converting sunlight into heat and wind applications for ventilation are just some of the technologies that can be incorporated to help reduce the energy impact of buildings. Mansfield (2009) states that careful integration of such products through design and specification is needed in order to meet the carbon neutral requirements of the Climate Change Act.

In addition, the WBCSD set out that reductions in energy generation and consumption can be achieved by:

- Using less energy - cut buildings' energy demand by improved design, using insulation and equipment that is more energy efficient

- Making more energy locally - produce energy locally from renewable and otherwise wasted energy resources

- Sharing energy – create buildings that can generate surplus energy and feed it into an intelligent grid infrastructure to balance the energy needs of other buildings

Stern in his 2007 review on the economics of climate change (Stern, 2007) stated that reductions in emissions from buildings' energy use is higher than that of any other sectors concluding that continued climate change will have widespread impacts on the global economy but that taking early action, such as reducing energy consumption in buildings to reduce emissions to combat climate change, the benefits far outweigh the costs. It is clear that the construction industry can make a significant impact in this regard and that incorporating energy efficient technologies such as those listed above, needs to start now in order to start making an impact.

2.4.3 Waste

Waste generation by the UK construction industry is significant in terms of its direct cost to the industry itself and its relative contribution to the overall national waste burden (Saunders and Wynn, 2004) as well as having a major impact on the environment. The RICS estimated that 40 per cent of all UK waste (including greenhouse gas emissions) is produced by the construction industry (cited in Pitt *et al.,* 2009). Around 420 million tons of materials are used each year in the construction industry in the UK, however only 360 million tons are incorporated into products with around 120 million tons of this resulting in waste (Osmani *et al.,* 2006). In 2003, the total construction, demolition and excavation waste in England was estimated at 91 million tons, up from an estimated 69 million tons in 1999 (ODPM, 2004) indicating an increase rather than a reduction in waste.

Studies such as Saunders and Wynn (2004) and Osmani *et al.,* (2006) demonstrate that although it is acknowledged that waste is a significant predicament in construction, the

industry appears reluctant to implement waste minimisation. For example, responses from the subcontractors interviewed in Saunders and Wynn's study clearly indicate that whilst they are aware of waste as an issue for the industry, they are prepared to accept levels of waste at 10% suggesting that even though they are aware of the issue they are more than happy to continue generating current levels of waste.

The government has projected that landfill capacity will be reached by 2017 (Better Buildings Summit, 2003, cited in Pitt *et al.,* 2009) thus figures as above give grave cause for concern. Whilst the introduction of the Landfill Tax and Aggregate Levy has helped to drive the reduction and minimisation of waste due to the increased cost associated with disposal (OECD, 2006), the literature indicates that there is still much to be done in this area if we are to meet the proposed reductions in emissions set out by the Government and reduce landfill.

The use of modern methods of construction (MMC) has been advocated as a way to achieve waste reduction (Pan, Gibb and Dainty, 2007). The effectiveness of such methods has been demonstrated by Ozorhon (2013) who presents the results of three award-winning construction projects from the UK all of which use SCPs. Case study one, a housing association that owns and manages homes across the UK, through the use of MMC achieved waste reductions in excess of 50%. Through using timber frames, higher levels of environmental sustainability, enhanced thermal performance and decreased impact on the environment through lower carbon emission, a 6% reduction in waste to landfill and 74% increase in waste recycled against 10% targets were also achieved.

2.4.4 Water Consumption

Water is essential for life and without it humans will die. There is no substitute for water (Conard, 2013) and thus reducing water consumption in buildings and improving water efficiency is a major aspect of SD.

A report by DEFRA (2008: p8) 'Future Water' states:

"*Water is essential for life. It is vital for our health and wellbeing, and for agriculture, fisheries, industry and transportation. Healthy water resources are necessary for a high-quality natural*

environment. Water provides us with countless benefits as we swim in it, sail on it, water our gardens and take pleasure in the plants and animals which depend on it. Healthy water environments, such as wetlands and floodplains, also provide natural water storage and flood protection".

The construction industry accounts for 12% of potable water usage (Dixit *et al.,* 2010) contributing to the impact on depletion of water resources. The last 30 years has seen water consumption rise by 70 per cent in the UK (Brownhill and Yates, 2001). With estimates that 4.1 million new households will be needed in the UK by 2016, such requirements will further increase and have a further impact on water supply (Edwards, 2002). In addition, with figures such as that from the World Health Organisation who in 2000 stated that 1.1 billion people lack safe drinking water and recently reported that this figure is set to nearly double by 2015 (WHO, 2002; 2013), not only is water an essential resource it is an urgent resource that needs urgent attention.

Your Building, an Australian website dedicated to Sustainability, states that the benefits of implementing water efficiency initiatives in buildings may include:

- cost savings in annual water bills, particularly when the price of water is likely to increase, based on the current drought conditions;
- adding to the corporate image of a business/organisation;
- reduced energy costs and greenhouse emissions;
- helping to ensure water is available for future generations.

In 2008 the WWF reported that around 50 countries at that time faced moderate to severe water stress (WWF, 2008). Climate change has resulted in less rain fall in recent years meaning that water supplies are even scarcer. By 2080, some long term climate projections forecast half as much rainfall in summer (DEFRA, 2008). Conard (2013) reports some hard hitting statics regarding the actual availability of water in that out of the total water on the planet, only 0.003% of this is readily available (97% is too salty to drink and 90% of the remaining 3% is frozen).

The contribution the construction industry can make to SD is clear. The potential role of the construction industry in reducing energy use and therefore contributing positively to the agenda for climate change is clear, as there is no denying that construction is a major contributor to CO2 emissions (Roaf, Crichton, and Nicol, 2005). Cotgrave and Kokkarinen (2010: p266) point out that "*if changes are made to the design of buildings and construction processes, the potential for slowing down environmental degradation could be significant*". The International Council for Innovation and Research in Building and Construction (CIB, 1999: p17) set out just how significant the construction industry is to sustainability their report, Agenda 21 on Sustainable Construction in which they stated that "*the pursuit of SD throws the built environment and the construction industry into sharp relief. This sector of society is of such vital innate importance that most other industrial areas of the world society simply fade in comparison*".

Myers (2005) reviewed the annual reports of 42 construction companies in the UK and found little information related to sustainability was disclosed, and relatively few large companies changed their business paradigm. Again in a US study (Chong *et al.,* 2009) in which the authors surveyed over 200 civil engineers, nearly all of the respondents felt that sustainability is important or relatively important in the construction industry however highlighted that actual application and implementation by their organizations is extremely low. A more concerted effort is required by industry in aligning their practices with SD. The demand for economic growth and development shows no sign of diminishing (Bennett and Cruddington, 2003) and with reports by the Worldwatch Institute that by 2030 the world will run out of several raw materials for construction (Brown, 1990 cited in Gorgolewski and Ergun, 2013), water shortages (WHO, 2013), particularly in the UK (Garland *et al*., 2009) and poverty levels still at problematic levels (Olinto *et al.*, 2013), it is imperative that efforts are made to start achieving SD. The next section of this paper reviews the possible reasons for inertia through a review of the drivers and barriers towards SD.

2.5 Barriers towards SD within the Construction Industry

Given the inertia identified towards SD within the literature and in many of the Government reports, a growing body of literature has begun to investigate the reasons for this. Four main

barriers have been identified, namely cost, responsibility, understanding/knowledge and issues regarding policy and legislation.

2.5.1. Cost

Cost is a major barrier to adopting sustainable approaches. Yang *et al.* (2005: px) state "*affordability is the cold reality for stagnation in some aspects of SD*". Evidence for this comes from studies carried out by Cotgrave (2008), Pitt *et al.* (2009) and Sponge (2004). When asked what the key barriers to the industry for sustainable construction are respondents in these studies indicated that cost/affordability was the main barrier. Such perceptions are however unfounded based on the pure assumption that, if the building is green, it must cost more (Hoffman and Hen, 2008). A survey by the WBCSD in 2007 found that people tend to overestimate the cost premium of green building to be between 11% and 28% more than a normal building, with an average overestimation of 17%. This is worrying given there appears to be a common consensus that unless adopting sustainable practices and use of sustainable materials achieves costs savings, the same will not be widely implemented (Constructing Excellence, 2008; Baker and Associates, 2006). Professional bodies such as the Chartered Institute of Building (CIOB, 2001) and the WBCSD (2007) however report how the construction industry can move SD forward while still making a profit. The report by WBCSD (2007: p60) states that "*There is emerging evidence that an energy-efficient building can command a premium, and this may grow as awareness of the link to climate change and expectations of rising energy costs leads more people and organizations to attach more value to energy efficiency*". Such claims are evidenced by reports from companies such as McGraw Hill Construction (2006) who found that clients opting for sustainable buildings expect greener buildings to achieve an average increase in value of 7.5% over comparable standard buildings, together with a 6.6% improved return on investment.

Exemplar projects demonstrate how building sustainability can result in improved returns on investment. The Taipei 101 building in Taiwan for example cost $2 million in investment to retrofit. Energy, water and waste management through design of the same yielded savings of $700,000 per year meaning a payback investment in full in less than 3 years. Indeed reports from leading management consultants such as McKinsey and Co. have found that many green building technologies have positive financial benefits with cost savings resulting from many

green building technologies often exceeding the investment costs (Enkvist *et al*., 2007). Research clearly demonstrates that there are a large number of benefits from building green, which are received by different stakeholders throughout the building life cycle, yet the cost benefits and indeed the many other benefits of SD are often not articulated to clients and stakeholders (RICS, 2013).

2.5.2 Policy and Legislation

In the UK, sustainable construction is still primarily a policy imperative driven by the public sector (central and local government) rather than by private sector market and client demand (Cooper *et al.,* 2005) yet it has been identified that patterns of ambiguity in legislation are an obstacle for changing the sector's mind-set. Rodriguez-Melo and Mansouri (2011) reported that 42% of respondents in their study (project managers and company strategists) perceived government as unclear and unspecific, thus leaving gaps for misinterpretation. On the other hand, more government legislation, regulations and 'positive' incentives are seen by some as one of the main drivers for promoting sustainability (Cooper *et al.,* 2005). However as Cotgrave (2008) points out, it is unlikely that government will introduce such legislation as to do so would risk alienating industry by impeding their ability to make profits, a move likely to be hugely unpopular and ultimately a vote loser. Government ultimately rely on co-operation so even if they do impose more policies and regulations, their effectiveness relies on the response of industry (Murray, 2011). In addition, whilst sustainability legislation has been shown to be a corporate driver for change the extent to which legislation changes attitudes is debatable (Meehan and Bryde, 2013). This is illustrated by the fact that despite strong policy drives by UK government in recent years, many new developments in the UK still incorporate few sustainability features (Williams and Dair, 2006) with much of industry unwilling to go above and beyond 'minimum requirements'. Industry needs to adopt sustainability of its own accord and thus there is an imperative need to change attitudes and perceptions so that they are able to 'create' a market demand for sustainability. Firms within industry that do so, will not only help to protect the environment but give themselves a competitive edge in an ever growing sustainability focused market but will also.

2.5.3 Understanding/Knowledge

Leal Filho (2000) states there are various reasons why the concept of sustainability may be hard to understand namely that sustainability:

- is not a subject per se since it is not classified as being of the domain of any given science but rather a component which may be incorporated into all disciplines and thus there tends to be a trend towards perceiving it as an abstract concept
- is too recent a field for its urgency to be seen as important
- is a fashion and will eventually go out of date
- is too theoretical
- is too broad a concept and therefore impossible to handle and thus achieve

The fact that over 60 definitions of sustainability now exist as previously mentioned (Hartshorn *et al*., 2005) only serves to add to the confusion with many claiming that some definitions of SD, such as those contained within the Government's UK Strategy for SD, are too broad, giving a wide ranging set of guidelines making it very difficult to draw conclusions on how successful current practice is in achieving such a wide remit of aims (Baker and Associates, 2006).

Knowledge of SD products is also a barrier. Baker and Associates (2006) surveyed developers and local planning authorities and reported that respondents claimed that it can be hard to find out about products and compare their effectiveness and that this is also linked to the issue of cost i.e. a lack of information about the wider financial implications in relation to the use of new technology. In addition construction professionals are unaware of how best to implement sustainable practices. Constructing Excellence, (2008) found that there was a lack of knowledge pertaining to sustainable products particularly in relation to installation and maintenance. Others (Griffin *et al*., 2010; Seo, 2002) have also reported that information on building materials is often incomplete or difficult to interpret, particularly in cases when project teams are comparing materials produced by different building industries. A report by the RICS (2013) also comments that a lack of awareness and understanding amongst client

advisors of the benefits of SD is a barrier to the uptake of design approaches to zero carbon buildings.

The report by the WBCSD previously mentioned was a 3-year project launched in 2006 and commissioned research therein to investigate barriers to implementing energy efficient measures. The summary as at 2007 reported that there were serious gaps in energy efficiency knowledge amongst building professionals with a tendency to underestimate the contribution of buildings' energy to climate change, and overestimate the cost of saving energy. The research was global (eight countries – Japan, China, India, Brazil, the US, Spain, France and Germany) and so findings cannot be generalized to the UK, however the findings indicate that knowledge, know-how and experience is lacking across industry globally, and that relatively few professionals have actually been involved in green building with the amount of involvement varying from region to region. Again in Saunders and Wynn's (2004) study, a lack of knowledge as to the root causes of waste was identified as a reason for not implementing proper waste management practices. Their findings have been corroborated by Kalatunga *et al.* (2006) who also found that a lack of training has obstructed proper waste management practices being implemented. Such barriers are likely a major causal link to inertia within the construction industry. This coupled with fear of the unknown and fear of risk pertaining to costs all have an adverse effect against progress towards sustainable practices in the industry.

2.5.4 Responsibility

There are mixed views as to where responsibility for sustainable practices lies particularly in relation to waste minimisation. Saunders and Wynn (2004) assessed subcontractors' attitudes towards waste minimisation, and found that eighty-five per cent of all respondents felt that the main contractor should bear the full responsibility of waste minimisation. Osmani *et al.* (2006) report that poorly defined responsibilities are leading to confusion as to who should control and monitor waste management finding that architects argued that waste was an issue for contractors, while contractors countered that a failure to address waste generation in design and poor waste management by subcontractors were the consequences of a lack of definition regarding roles and responsibilities in a contract. A further study by Osmani *et al.* (2008) assessing architects' perspectives on waste reduction through design

corroborated their earlier findings. This uncertainty and shifting of responsibility is clearly a barrier towards the adoption of sustainable practice. In relation to the architects, this is a worrying fact as research shows that poor design is a major contributor to waste. Construction professionals are not aware of the environmental damage they are causing and due to deferred responsibility no responsibility can be assumed (Lo *et al.*, 2006). This uncertainty and shifting of responsibility is clearly a barrier towards the adoption of sustainable practice.

Findings here and elsewhere evidence that many professionals are willing to undertake SCPs but that due to the above barriers, a level of consternation permeates the industry with many remaining sceptical and unenthusiastic as a result. This coupled with fear of the unknown and fear of risk pertaining to costs all have an adverse effect against progress towards sustainable practices in the industry.

2.6 Government and Sustainable Development

A series of high-profile international summits (Earth Summit+5, New York, 1997, Rio de Janerio, 1992, Johannesburg, 2002; Rio de Janerio, 2012) have introduced protocols that have forced signatory governments to be more pro-active in addressing a range of sustainability problems in the built environment including energy conservation and the reduction of CO2 emissions (Mansfield, 2009).

The UK became one of the first countries to produce a SD strategy in response to the call made at the 1992 Earth Summit at Rio. Born out of the Rio 1992 summit was Agenda 21 (A21; CIB, 1999), a 300 page document which describes a global action plan for SD. A21 has a strong focus of SD at a local level given that many of the problems and solutions being addressed by the A21 have their roots in local activities. As a result of this, it is recommended that local authorities adopt a local agenda known as Local Agenda 21 (LA21). One of the main requirements of LA21 is that local authorities should consult with their communities and other stakeholders to reach a consensus on the implementation of SD. Since the introduction of A21, Governments have strengthened their commitment to SD through legislation and the development and implementation of international, regional and sub-regional agreements and commitments (UN, 2012).

In terms of construction, the UK Government first set out its commitment to sustainable construction in *Sustainable Development: The UK Strategy* (HMG, 1994). *Following on from this the Government then released* Building a Better Quality of Life (HMG, 1999) which set out that the construction industry can contribute to the achievement of SD by:

- being more profitable and competitive;
- delivering buildings and structures that provide greater satisfaction, well-being and value to customers and users;
- respecting and treating its stakeholders more fairly;
- enhancing and better protecting the natural environment;
- minimising its consumption of energy (especially carbon-based energy) and natural resources.

Since then the Government has reviewed these strategies on a regular basis (HM Government, 2005; HM Government, 2008; Cabinet Office, 2011) with its latest offering being that of 'Construction 2025: Industrial Strategy for Construction - Government and Industry in Partnership' (BIS, 2013). Construction 2025 sets out a vision which includes five key components towards a long-term vision for the industry in 2025, of which one of the key components is sustainability. Part of this sustainability vision is to lead the world in low-carbon and green construction and also to become dramatically more sustainable through its efficient approach to delivering low carbon assets more quickly and at a lower cost. The strategy is built around achieving four headline objectives by 2025:

- **Lower costs:** a 33% reduction in initial costs of construction and the whole life cost of built assets
- **Faster delivery:** a 50% reduction in the overall time from inception to completion for new build and refurbished assets
- **Lower emissions:** a 50% reduction in greenhouse gases emission in the built environment

- **Improvement in exports:** a 50% reduction in the trade gap between total exports and total imports

These figures have significantly increased since the 2011 strategy (from 20% to 33% in costs for example) putting increased pressure on industry to reduce its impacts and with the targets set by the legal requirements under the Climate Change Act (2008) adding further pressure. None of the strategies are prescriptive and so industry is left to its own devices in terms of acting upon the targets. Help and guidance is offered however through organisations such as the Green Construction Board (GCB) which was set up following the Strategy for Sustainable Construction 2008. The GCB provides a number of reports on the various aspects of SD (waste, water, carbon, materials, and biodiversity) which form part of a series of outputs aimed at supporting the delivery of the targets within the Strategy. How aware industry are of such organisations and the advice offered however is another matter.

One of the mechanisms by which Government hopes to meet its efficiency targets is through that of Building Information Modelling (BIM). BIM is a key thread running through the 2013 strategy and has been mandated on all publicly procured projects by 2016. Typically construction is not very efficient and within the construction process 30% of the construction process is rework, 60% of the labour effort is wasted, 10% loss is due to wasted materials, 3-5% of the construction turnover is lost at discipline interface and loss of interoperability (BIS, 2013), which is mostly due to construction information often being inaccurate, incomplete and ambiguous. Government in recognising the opportunities for improvement in these areas has identified BIM as an enabling tool to reach its targets set out in the 2013 strategy. The initial estimated savings to UK construction and its clients is £2bn per annum through the widespread adoption of BIM. An important aspect of BIM is that it brings together all the parties involved in the construction process at an early stage, which is when key design decisions are made which means that sustainability considerations can be dealt with right at the beginning of the process. However as Bryde *et al*. (2013: p979) point out, "*using BIM to its full potential to deliver on the sustainability agenda will only be achievable if the people using it adapt and adopt working practices to suit*". Again this will require a fundamental shift in the way the construction industry operates requiring a shift first in in attitudes and behaviour.

Another of the key drivers highlighted as needed to deliver the strategy is that of increased capability in the workforce. Given the lack of knowledge amongst industry professionals, it seems obvious and indeed absolutely necessary to educate both professionals and future professionals on SD issues and the policies and legislation that surrounds them. The GCB is carrying out research to map the current skills landscape in respect of 'green construction' and identify barriers that may prevent the industry from meeting demand through to 2025. How dissemination will be implemented is another issue altogether however and this is where the HE sector can assist.

2.7 Education for Sustainability: History and Progress

SD involves and requires fundamental societal transformations, which can only result from a process of societal learning (Kates *et al*., 2001). Consequently, education and learning are key to achieving SD (Barth *et al*., 2007; Vare and Scott, 2007). HEIs play a critical role in driving economic growth and social mobility making them vital to the future prosperity and wellbeing of society (Universities UK, 2013). They not only generate and transfer relevant knowledge, but they also educate future decision makers to enable them to contribute to a more sustainable future (Cortese, 2003; Gough and Scott, 2007), also offering students the perfect base to begin to grasp SD as a holistic concept and explore ideas which provide solutions to coping with the trade-offs between economic, social and environmental goals (Sedlacek, 2013; Sibbel; 2009). Given the pressure on the construction industry to contribute to SD, there is perhaps nowhere more important than BUE programmes to embed SD curricula. There are 165 HEIs in the UK, of which 111 provide architecture, building and planning courses (UCAS course search return results, 2014) meaning the opportunities for achieving SD in BUE education and subsequently construction are vast. Yet whilst postgraduate and CPD courses on SD are available at some universities, it is not widespread. In addition, only twelve UK universities have signed the Talloires Declaration (USLF, 2014) and only 32 UK institutions have signed the Copernicus Charter (Murray and Cotgrave, 2007).

There has been a growing development of education for SD (ESD) with a great deal written about the need to embed sustainability within HE over the last decade (Fien, 2002; Boyle, 2004; Lourdel, Martin and Bererd, 2006) with many proponents of SD who believe that the

SD agenda and construction education are inextricably linked (Ekundayo *et al.,* 2011; Walton and Galea, 2005; Cotgrave and Alkhaddar, 2006; Hayles and Holdsworth, 2008; Barth *et al*., 2007; Vare and Scott, 2007). Indeed, there is an increasing consensus from both the Government and HEIs that educating the youth of today on SD issues is important to drive changes within the construction industry. The UN declared 2005-2015 the "*Decade for Education for SD*" (UNESCO, 2003) and in response to this, Haigh (2005: p32) stated that the decade "*. . . offers academics the best chance to date for making the deep and radical changes that will be necessary if the world's HEIs are to enact their responsibilities for creating a better and self-sustainable world*". The UK government in tandem with the UN, has an on-going commitment to promoting ESD which is emphasised in the UK's official SD strategy, which asks educators "*to make sustainability literacy a core competency for professional graduates"* (HMG, 2005: p39).

Environmental education, a component of ESD has been around for decades however ESD encompasses much more than the environmental aspects. As the UN set out when it declared the decade for ESD, environmental education *"is a well-established discipline, which focuses on humankind's relationship with the natural environment and on ways to conserve and preserve it and properly steward its resources"* but that whilst SD, encompasses environmental education*,* it also *"sets it in the broader context of socio-cultural factors and the socio-political issues of equity, poverty, democracy and quality of life"* (UNESCO, 2004). Thus ESD should equally address all three pillars of SD, society, environment and economy (Milutinov and Nikoli, 2014) yet research investigating the embedding of SD into the curricula shows that the environmental dimension is still given credence over the other dimensions and that in most cases the social and economic are not considered at all (Ekuyndayo *et al*., 2011; Garland *et al*., 2009).

ESD within the context of the three pillars should address learning skills, perspectives, and values that guide and motivate people to seek sustainable livelihoods, participate in a democratic society, and live in a sustainable manner and involve studying local and, when appropriate, global issues (UNESCO, 2006). For construction professionals this should also translate into their working practices and thus needs to be instilled during their formative years in education.

A guide published by Forum for the Future, Learning and Skills for Sustainable Development, (Forum for the Future, 2004: p9) recommends that in order for graduates to be sustainability literate they should:

- understand the need to change to a sustainable way of doing things, individually and collectively;
- have sufficient knowledge and skills to decide and act in a way that favours sustainable development; and
- be able to recognise and reward other people's decisions and actions that favour sustainable development.

For construction disciplines, the CIB as long ago as 1999 reported that sustainable building principles should be incorporated not only into the curricula of 1st degree training courses for architects, designers and construction engineers, but also in Continuing Professional Development (Cotgrave, 2008).

Many universities have now undertaken action towards implementation, however this in itself has been thwarted with problems, and numerous case studies, as well as studies on the drivers and barriers of such processes, have been documented (Ferrer-Balas *et al.,* 2009; Garland *et al.*, 2009; Lidgren *et al.,* 2006; Lozano, 2006; Jones *et al.,* 2008; Thomas, 2004). The dynamic and contested nature of sustainability has given rise to delivery of SD in practice being patchy and a difficult subject to develop making the teaching of the subject fraught with difficulties (Lourdel, Martin and Bererd, 2006). Drayson *et al.,* (2012) state that many in HEIs lack the confidence, know how or knowledge to do so which has also lead to ESD becoming disjointed at a national level. A number of authors have described the problems of establishing SD courses (Leal Filho, 2000; Thomas, 2004) with the reasons they highlight diverse. Lourdel, Martin and Bererd (2006: p2) state that whilst many universities now offer courses incorporating SD, "*in practice this may amount to only three to six hours of teaching, and may only be delivered to learners who have specifically opted to study the subject. How is it possible to explain all the concepts associated with sustainable development in just six hours, even assuming that this is available and that all learners are participating? Simple presentations cannot hope to offer learners the opportunity to incorporate personal*

reflections and to engage fully with this complex subject. Although conferences allow professionals some insight into sustainable development, they can only be regarded as awareness raising, rather than real training".

Where HE efforts are prevailing, industry is however failing to act upon the same. Generation for Collaboration' (G4C), the early career forum of Constructing Excellence, reported on the experience of recent entrants to the industry as part of the research for the Wolstenholme report. One question the research asked was what had attracted graduates to the industry, what development they had received since graduation and how their experience compares with other industry graduate programmes. Respondents pointed out the failure of the industry to address the single most important issue that the next generation has to face, that of SD and, in particular, a low-carbon economy. Further, a report by the Higher Education Academy (Drayson *et al.,* 2012) reports that first-year students indicate that they are willing to take jobs with a small remuneration sacrifice in order that they are able to work in a socially and ethically responsible company, indicative of a future demand for the skills to project students into this graduate environment with 80% of respondents believing sustainability skills are going to be important to their future employers and the majority of first-year students involved believe that it is the role of universities and courses to prepare them for graduate employment**.** Such reports demonstrate student demand however it appears that industry are not yet fully prepared to deal with such demand and ergo, by not embracing the SD agenda, are missing out on a huge opportunity to attract young people to the sector which has also been highlighted as an issue within the industry (BIS, 2013). There is an imperative need to change attitudes in industry so that students graduating with the skills and knowledge are able to apply them.

In addition, as a relatively new development during the last decade, this means there are only a handful in industry presently with such training and knowledge. There are over 2 million employees in the construction industry meaning the majority of this population will not have been trained or educated whilst in higher education on sustainability issues. Murray and Cotgrave (2007: p9-10) point out *"few professionals are likely to fully comprehend sustainability issues or be equipped with the attributes that would enable them to take decisions that sustain, rather than degrade the world around them. Consequently, the need*

to equip them with sustainability-relevant knowledge, skills and values comes into stark focus". As stated above, the poor sign-up to the Talloires Declaration and Copernicus Charter evidence that there are also at present not enough graduates to make a difference.

Further, Chan *et al.,* (2002) indicate that professionals are unsure as to where to go to update their knowledge on sustainability practices again highlighting the urgent need for education and knowledge on sustainability to be embedded into the industry itself. As such, the need for educating professionals as well as undergraduates is paramount. As Graham (2000: p924-925) states:

"Understanding the problems is fundamental to designing the solutions…Environmental literacy is a goal that requires that proponents not only know how to design, construct and manage buildings that contribute to ecology sustaining development, but also are committed to act for the future on the basis of their knowledge. It is crucial that building professionals not only participate in the creation of projects that have low environmental impact in terms of materials, processes and operational energy consumption, but equally it is important that they learn to conceive, nurture, promote and facilitate the kind of paradigm changes seen as necessary to create a sustainable society".

Although there is an emphasis on providing education as a means for driving the agenda forward, research shows however that more than just providing knowledge may be needed as despite knowing about environmental crises, understanding their causes, knowing how to make change, and being committed to change, we still frequently do not behave according to our intentions (Kollmuss and Agyeman, 2002). Changing attitudes, particularly those of future decision makers within the construction industry is crucial to achieving SD in the built environment. As alluded to in the introductory chapter, psychology the field of human behaviour may provide some answers. As the aim of this research is to change attitudes, the next chapter discusses attitudes, how they are formed and shaped and how they affect our decision making. A review of the psychological literature pertaining to ESE and Optimism is then provided outlining the various ways in which they may be useful for attitude change.

2.8 Summary

This chapter provided a review of the literature pertaining to SD and attempted to set it within the context of construction. It also reviewed and highlighted the many challenges in implementing SD within the construction industry. In conclusion, this literature review established that:

- Sustainability and the construction industry are inextricably linked yet:
- There is a lack of momentum within the construction industry to adopt sustainable practices despite acknowledgment of the need to do so;
- There are a number of perceived barriers that further prevent the adoption of such practices;
- There is an urgent need to educate the construction sector on sustainability issues in an effort to lead to more sustainable practices;
- Ways of integrating SD into the curriculum have been problematic and thus new pedagogical approaches need to be established particularly for changing mind-sets.

3. Psychology and Sustainability

Psychology is the field for the study of human behaviour. It is a diverse discipline that can assist in many if not all aspects of life including sport, education, the judicial system and religion amongst others. Many measurement tools in each of these areas have been developed which seek to investigate and provide new information as to human functioning and behaviour in these contexts.

There has been a growing interest in studying SD from a psychological perspective particularly in relation to sustainable behaviour. The field of psychology and SD however is a relatively young area of research with psychology previously focusing on the environmental aspect leading to a wealth of research and literature in the field of environmental psychology. However, as the concept of SD has gained widespread momentum, environmental psychology has expanded to incorporate sustainability problems (see Vlek and Steg, 2007) and looks very promising for moving the sustainability agenda along. Indeed as Corral-Verdugo *et al.,* (2010: p7) state "*The elucidation of the psychological dimensions of sustainability is a primordial step in designing interventional strategies aimed at encouraging people to behave in accordance with sustainability principles*". Yang *et al's* (2005) 'bigger picture' which takes a bottom up approach, starting at the bottom with human values and aspirations eventually leading to SD demonstrates how starting with psychology can lead to sustainable behaviour. They state that the very crux of the issue for SD in the future is moving from a top down approach in our thinking, to a bottom up approach that stems from essential human aspirations. Coupled with Corral Verdugo's statement above, this makes for powerful persuasion to explore the potential of concepts of psychology towards a much needed interdisciplinary approach.

The main objective of this research is to develop a tool for eliciting attitude change. The remainder of this chapter provides an overview of attitudes, how they are formed and how they can be changed. It then moves on to theories of optimism and ESE which both stem from the social domain of psychology and which look promising for attitude change.

3.1 The Nature and Structure of Attitudes

The study of attitudes and attitude change has historically been one of the key topics of social psychology researched by social psychologists since the 1920s (Forgas, Cooper and Crano, 2010). Attitudes have been defined in various ways but all with similar meaning. Zimbardo and Leippe (1991) defined attitude as an evaluative disposition toward some object based upon cognitions, affective (emotional) reactions, behavioural intentions and past behaviours that can influence cognitions, affective responses and future intentions and behaviours**.** Schwarz (2007) defines attitudes as evaluative judgments that are constructed in the situation based on currently accessible information, whilst Schultz *et al*., (2004) define an attitude simply as an evaluative judgement about an entity. Whatever definition one uses, central to all definitions is that they comprise of cognitive, affective and behavioural components and involve some form of evaluative judgement of an object. These overall evaluations can be positive, negative, or neutral, and can vary in their extremity (Petty, Wheeler and Tormala, 2013) in that some attitudes we hold may be stronger than others depending on the object.

Attitudes are of interest within behavioural research as they often drive behaviour in that people tend to act favourably toward things they like and unfavourably toward things they do not like (Petty, Wheeler and Tormala, 2013). An attitude object refers to anything that can be evaluated along a dimension of favourability (Maio and Haddock, 2010) such as people, actual objects and situations.

Attitudes are often formed early and quickly in life and are influenced by a number of factors including our experiences, past behaviours, society, environment, family and friends, mood, place of work and the media amongst others. Each of these factors can impact on one or more of the cognitive, affective and behavioural components of attitudes. The cognitive component of attitudes refers to our beliefs, thoughts and attributes we associate with an object (Maio and Haddock, 2010) based on our factual knowledge of the object, person or situation. If we believe for example that conservation of land is important for the protection of wildlife our attitude towards oil development in areas of wildlife would therefore be negative. The affective component consists of a person's liking or emotional response to an object, situation or person and relates to levels of physical arousal we experience with said object/person/situation such as pleasure, sadness or fear (Simonson and Maushak, 2001).

Seeing the destruction of areas of wildlife might make a person feel sad or even angry thus the arousal of such feelings may cause a person to have a negative attitude towards the people or companies that partake in such activities. The behavioural component refers to a person's behaviour directed toward a situation/person/object.

Some authors argue that attitudes are stored in memory (Visser and Mirabile, 2004; Fazio, 2007; Petty, Brinol and DeMarree, 2007) and some argue that they are constructed (Schwarz, 2007; Conrey and Smith, 2007; Gawronski and Bodenhausen, 2007). This is a complex argument which has generated much debate with research in support of both arguments. Petty, Wheeler and Tormala (2013) however posit that they are both constructed and stored in memory. That is we can form new ones but we have many that pre-exist and which can be modified. Maio and Haddock (2010) argue that the answer to this depends on the attitude strength in that strong attitudes will be stable and enduring and weaker attitudes will be more flexible and likely to be constructed on the spot. In this context, Zimbardo and Leippe's (1991) definition of attitudes as learned predispositions to respond is appropriate. This predisposition to respond implies a purpose for attitudes. Understanding the reasons why people hold certain attitudes has been widely researched over the years. Functions attitudes are said to serve include helping express our values, identifying what and who we like or dislike, self-protection from negative feedback and making judgements faster and easier thus conserving mental energy (Maio and Haddock, 2010).

3.1.1 Attitude Change

Attitude change is the change in the evaluation of an object of thought (Bohner and Dickel, 2011). Given that we acquire attitudes, most researchers agree that they are "*subject to fairly predictable change*" (Simmons and Maushak, 2001: p84). As stated above, attitudes comprise of cognitive, affective and behavioural components and a number of influences can impact on each of these components. The influences that lead to attitude formation described above also influence attitude change and some authors do not make a distinction between formation and change and refer to attitude change as "*whenever people process information with the result of forming an evaluation of an object of thought*" (Bohner and Dickel, 2011: p397). The interrelatedness of attitude components is complex and a change in one component can result in a change in another. As acknowledged by Forgas, Cooper and Crano

(2010), attitudes are one of the areas in social psychology where attempts to separate cognition, affect and behaviour is most problematic. If a person is presented with new information (cognitive component) which changes their feelings toward the object (affective component) this may change their attitude and in turn their behaviour towards an object. For example if we have been using a beauty product for years but are an animal rights activist and we find out that the company whose products we use test on animals, information not previously known, this may cause us to feel angry and thus our cognitions (beliefs) about this company would change and most likely our behaviour, in that we would not purchase products from this company any more. In addition, as previously stated attitudes vary in their strength and thus some attitudes will be harder to change than others with stronger attitudes more resistant to change than weaker ones. The cognitive and affective components of attitudes may also influence the valence of attitude strength and thus targeting either or both would be important for attitude change. Much of the attitude literature has tended to focus on the cognitive component with the role of emotions often overlooked and ignored (Corral-Verdugo *et al.,* 2009; Carrus, Passafaro and Bonnes*,* 2008). This is somewhat unfortunate as some authors (e.g. Pooley and O'Connor, 2000) believe that the limited success of pro-environmental interventions may sometimes be explained by the emphasis on cognitive processes. Indeed attitudes are generally stronger when the link between their cognitive and affective components are consciously recalled (Zimbardo and Leippe, 1991).

Several authors (e.g. Carrus, Passafaro, and Bonnes, 2008; Kals, Schumacher and Montada, 1999) have postulated that pro-environmental behaviour is not only based on rational decisions but that it is also flanked and motivated by emotions (cited in Corral-Verdugo *et al*., 2009). Petty, Wheeler and Tormala (2013) however state that it is generally more effective to change attitudes that are emotionally based than cognitively based, a view supported by Zajoc (1980) who contends that the affective component many be the most important of the three as it is often the driving force behind responses to social stimuli, and perhaps the primary dimension of all interpersonal behaviour (cited in Forgas, Cooper and Crano, 2010). Indeed studies have evidenced that attitudes that are formed through direct experience (affect based) are also better predictors of behaviour (Millar and Millar, 1996). Such arguments support the contention that providing knowledge alone is not enough for attitude or indeed behaviour change (Beck, 1997; Lenzen, 1997; Pooley and O'Connor, 2000; Tilbury

and Cooke, 2005: cited in Kemmis and Mutton, 2012) and that the affective component of attitudes is perhaps, as Zajoc suggests, the primary dimension of attitudes. Iozzie (1989) also suggested that the key entry point for environmental education in addressing values and attitudes should be through the affective domain.

3.1.2 Influences of Attitude Change

One of the main methods of attitude change is through that of persuasion. As one of the oldest phenomena studied in social psychology, many theories of persuasion have been developed in relation to attitude change (Petty, Wheeler and Tormala, 2013), the breadth and scope of which is beyond the remit of this research. The literature on theories of attitude change is convoluted with many theories overlapping making it not only difficult to separate them but also to understand them (Simonson and Maushak, 2001; Petty, Wheeler and Tormala, 2013). One theory in particular however is worthy of mention as it provides a link between the many theories beyond the scope of this research (Simonson and Maushak, 2001) and is said to be fundamental in understanding attitude change, namely functional theory (Katz, 1960).

As previously stated, attitudes are said to serve a particular function whether this be to express our values, identify what and who we like or dislike or self-protection from negative feedback and making judgements about objects. Dillard (1993) suggested that the functional approach to attitudes should be one of the central foci of future persuasion research because of its important implications for attitude formation and change (cited in Lapinski and Boster, 2001). Indeed Katz (p170) argued that "*Unless we know the psychological need which is met by the holding of an attitude, we are in a poor position to predict how it will change*". Changing attitudes in this context means persuading targets that their attitude no longer serves the function it was developed for. Katz suggested that attitudes exist because they serve any one or a combination of four functions: (1) utilitarian, (2) ego-defensive, (3) value-expressive and (4) knowledge.

The utilitarian function posits that attitudes serve to maximize rewards and minimize punishments obtained from objects in one's environment (Katz, 1960). Utilitarian attitudes are usually associations to stimuli (Simonson and Maushak, 2001) and in this respect align

with Pavlov's classical conditioning theory in which the environment acts as the stimulus creating positive or negative emotional responses in individuals to an object, person or event by associating those feelings with the target object. When an object has been useful or helped us in the past, our attitudes tend to be favourable towards that object. If we have a negative attitude towards an object, persuasive appeals about the potential benefits of using a product may change the attitude. Utilitarian appeals in consumer research have involved informing consumers of one or more key benefits that are perceived to be highly functional or important (Johar and Sirgy, 1991).

The Ego-defensive function alludes to psychoanalytic theory which posits that people use defence mechanisms such as denial, regression or projection to protect their self-concepts against internal and external threats (Simonson and Maushak, 2001). Attitudes serving an ego-defensive function protect one's self-concept from counter-attitudinal messages about the self (Lapinksy and Boster, 2001). People want to protect their image and feel secure and have personal confidence in an object. Ego-defensive attitudes have been found to be particularly difficult to change (Zimbardo and Leippe, 1991).

The value expression function acknowledges the importance of self-expression and self-actualisation. Attitudes are a reflection of our general values, lifestyle and outlook on life thus aligning ourselves with certain objects projects the image we want to portray of ourselves. If we want to be seen as environmentally friendly for example, using sustainable materials in a house we build will portray that we care for the environment. Attitude change has shown to be more likely if the object of evaluation is perceived to have characteristics that are positively valued than if the object of evaluation is perceived to possess attributes that are negatively valued (Johar and Sirgy, 1991).

The knowledge function exists in attitudes that give meaning to the individual and their relation to objects in the environment (Maio and Olsen, 1995) and helps to organise and structure one's environment and provide consistency in one's frame of reference. Individuals have a need to understand things we encounter in order that we can make judgments about them and thus all attitudes probably serve this fundamental function to some extent (Shavitt,

1990). For attitude change to occur then, reframing of knowledge needs to occur for example that the costs of using sustainable materials are not as expensive as one thinks.

Persuasion theorists recognise that different processes can lead to attitude change in different circumstances (Petty and Wegener, 1998). Two models that have been particularly influential in this field are the Elaboration Likelihood Model (ELM; Petty and Cacioppo, 1986a, 1986b) and the Heuristic–Systematic Model (Chaiken, 1987; Chaiken, Liberman and Eagly, 1989). These models are very similar and can generally accommodate the same empirical results, though the explanatory language and sometimes the assumed mediating processes vary (Petty, Wheeler and Tormala, 2013). Both models however assume that an individual's cognitive activities may be mapped onto a continuum of processing effort in that some processes of attitude change require relatively high amounts of mental effort, whereas other processes of persuasion require relatively little mental effort (Bohner and Dickel, 2011). This continuum is defined by the level of motivation and ability that a person has to assess the central merits of an attitude object (Petty, Wheeler and Tormala, 2013). Our cognitive resources are limited and thus we cannot process in depth the details of every persuasive message and the amount of effort expended is generally dependent upon an individual's motivation and ability to processes a particular message. When motivation and ability are high, (e.g. people are interested in a topic and have knowledge of the same in order to process the information) people are more likely to exert more effort in scrutinising all available object-relevant information. Attitudes that are changed by low effort processes are postulated to be weaker than attitudes that are changed to the same extent by high effort processes**.**

Many variables are capable of influencing whether attitude change is likely to occur by the high or low effort processes. These motivational and ability variables may be a part of the persuasion situation, whereas others a part of the individual. Some variables affect mostly the amount of information processing activity whereas others tend to influence the direction or valence of the thinking (Petty and Wegenger, 2009).

Particular variables in persuasion have been shown to be effective for attitude change. The source of information has been shown to be particularly important for attitude change. Source credibility including, expertise, trustworthiness, and likeability of a source have all

been shown to be important factors for attitude change (Pornpitakpan, 2004; Rieh and Danielson, 2007). Source credibility has also been found to influence the confidence/doubt people have in the thoughts they generate in response to a persuasive message (Brinol, Petty and Tormala, 2004). Tormala *et al*. (2006) demonstrated that when people generate positive thoughts in response to a message that contains strong argument, and then learn of the source, high source credibility leads to more favourable attitudes than does low source credibility. However this is only the case when the message argument is strong as they found that when the message is weak, people tend to have negative thoughts and that low source credibility actually elicited more favourable attitudes than high source credibility indicating that the strength of the message argument may be more important than the source itself.

From a motivational perspective, perceived personal relevance or importance of the communication has been argued to be one of the most important variables for influencing a person's motivation to think (Petty and Cacioppo 1979; 1990; cited in Petty and Wegener, 2009). Celsi and Olson, (1988) deem personal relevance of an attitude object to be the extent that the individual perceives the object to be self-related or in some way instrumental in achieving their personal goals and values. Research by Liberman and Chaiken (1996) showed that high levels of personal relevance increase attitude while low levels have the opposite effect. Claypool *et al*. (2004) studied the effect of personal relevance, repetition, and argument strength on attitude change. They found that message repetition increased attitude change in low relevance and weak arguments, and also high relevance and strong arguments. However, attitude change was found to be negative for high relevance weak arguments, and decreased further with low relevance strong arguments. However, when participants were shown messages repeatedly that were not personally relevant, their attitude toward the message decreased with every repetition of the message indicating that both argument strength and relevance are important for more effective attitude change.

Mere exposure to an object has also been shown to affect attitudes with more exposure to an object leading to greater favourability/likeability for the object in question (Campbell and Wright, 2008). Thus increasing exposure to objects would likely change a person's attitude. Bornstein *et al*. (1987) demonstrated that participants' attitudes towards subliminally presented stimuli became significantly more positive with repeated exposure, even when

participants were unaware that exposures had occurred. However as Campbell and Wright, (2008) point out, with such exposure tasks there is a point of diminishing return for exposure in that after a certain number of times, individuals start to develop negative attitudes towards objects. Findings such as that from Claypool regarding repetition also need to be borne in mind in this respect.

Persuasive messages including imagery have demonstrated to be a powerful tool in eliciting attitude change (Maio and Haddock, 2010; Forgas, Cooper and Crano, 2010). However as with much of the attitude literature, this has been met with mixed results. Sinatra *et al*., (2012) in a study using persuasive text as a means for attitude change regarding climate change found that there were no significant differences between those who read a persuasive text with the inclusion of a provocative image than those who read the persuasive text alone. However Leiserowitz (2006) found that the use of affective imagery in climate change messages increased risk perception of climate change amongst participants. Based on these findings, it may well be worthwhile introducing imagery intended to evoke emotions towards sustainability issues to assist in facilitating attitude change.

3.1.3 Measuring Attitudes

As attitudes are a latent construct they cannot be observed directly (Milfont and Duckitt, 2010). Thus, rather than being measured directly, attitudes have to be inferred from overt responses (Himmelfarb, 1993). Attitudes can be measured directly through the use of measurement devices such as the Likert scale (survey approach) or indirectly through inferred observation of reactions, judgments or behaviours. Measuring attitudes is important to determine whether peoples' attitudes have changed in light of new information or some form of intervention (Petty, Wheeler and Tormala, 2013). At present no validated measure exists to capture and quantify attitudes towards all 3 dimensions of SD. It is important that such a tool be created if we are to find and develop ways of changing these attitudes. The next chapter describes the creation and validation processes undertaken to develop such a measure, the Sustainable Development Attitudes Measure (SDAM) however first a review of other relevant psychological literature is presented.

3.2 Emotional Intelligence and Emotional Self-Efficacy

3.2.1 Emotional Intelligence

Emotional intelligence (EI) refers to the ability, capacity, skill, or self-perceived ability to identify, assess, and manage the emotions of one's self, of others, and of groups. People who possess a high degree of EI know themselves very well and are able to sense the emotions of others. Individuals with high EI are said to be affable, resilient, and optimistic, traits which are important for the construction industry and more importantly SD.

Some authors contend that EI can be conceptualised as either a cognitive ability involving the ability to perceive, use, understand and manage emotion (Mayer and Salovey, 1997; Mayer, Salovey and Caruso, 2004) known as 'ability EI', or a personality trait related to dealing with emotions (Schutte *et al*., 1998; Petrides, Pita and Kokkinaki, 2007) known as 'trait EI'.

Ability EI is represented by the four branch model (Mayer and Salovey, 1997) which explains the levels of processing involved in ability EI:

- **Perceiving and identifying emotion** – in one's self and others thorough facial expression, body language and vocal expression including tone.
- **Using emotion to facilitate thought** - generate, use, feel and reason with emotion for communication purposes.
- **Understanding emotion** – understanding complex emotions and emotional "chains," and how emotions transition from one stage to another and appreciating the meaning and consequences of this.
- **Managing emotion** – being open to feelings and being able to manage emotions in oneself and in others.

Trait EI is represented by the Mixed or Trait Based model (Goleman, 1995; Barr-On, 1997) which presents twenty-five competencies arrayed in five clusters (Boyatiz, Goleman and Ree, 2000):

- **Self-awareness** - Emotional awareness; accurate self-assessment; and self-confidence.
- **Self-regulation** - Self-control, trustworthiness, conscientiousness, adaptability, and innovation.
- **Motivation** - achievement drive, commitment, initiative, and optimism
- **Social awareness** – Empathy, understanding others, organisational awareness, service orientation developing others.
- **Social skills** – Influence, communication, conflict management, leadership, change catalyst, building bonds, collaboration and cooperation, and team capabilities.

It is now generally acknowledged that trait EI and ability EI are different constructs (Petrides, 2011). However both these models whilst distinct in some aspects, share a commonality in that EI involves being able to perceive, evaluate, regulate and express one's emotions (Songer and Walker, 2004).

3.2.2 Emotional Self-Efficacy

Self-efficacy refers to an individual's beliefs about his or her ability to display a certain level of performance in a given ability (Bandura, 1997). Self-efficacy especially assumes that individuals can change their behaviours by change in their belief systems and by clear goal setting accompanied by mastery experiences and self-regulation. ESE is therefore concerned with one's perceived self-efficacy in relation to one's EI (Choi, Kluemper and Sauley, 2013). In general people often act on their beliefs about their abilities as opposed to their actual abilities (Mayer, Caruso, and Salovey, 1999). So whilst an individual may have high EI, a lack of SE in this domain may prevent them from using this ability (Kirk *et al.,* 2008; Qualter, Barlow and Stylianou, 2011). It is argued that self-efficacy is seen as even more important than actual task related abilities and skills in explaining individual differences in performance (Gundlach, Martinko, and Douglas, 2003) and so it follows that self-efficacy in relation to emotional capability is likely to be an important factor in EI research (Dacre Pool and Qualter, 2013).

As a relatively new field, little empirical investigation has been undertaken in relation to people's beliefs regarding their emotional skills and knowledge. Investigations in the field

however have shown that people who believe they have some control over their emotional competencies are more successful in regulating their emotions than those who believe that this is something they cannot control effectively (Bandura *et al.,* 2003; cited in Dacre Pool and Qualter, 2013). Given the lack of empirical evidence pertaining to ESE, the majority of the studies presented below pertain to EI. The evidence is presented however with the underlying contention that the positive EI outcomes in the studies may well in fact be due to peoples' SE in utilising their EI abilities.

3.2.3 ESE for SD in Construction

EI has been investigated in relation to a number of different variables including: academic achievement, life satisfaction, anxiety, problem-solving and coping ability all of which are relevant in workplace, education and interpersonal situations (Bastian *et al.,* 2005). EI has been shown to augment positive work attitudes, altruistic behaviour, and work outcomes (Carmeli, 2003) indicating that it may be a useful construct in relation to sustainability and attitude change. Ample evidence suggests that adaptive emotional functioning predicts important work-related outcomes (Dacre Poole and Qualter, 2012). Serrat (2009) postulates that EI is relevant to important work-related outcomes such as individual performance, organizational productivity, and developing people because its principles provide a new way to understand and assess the behaviours, management styles, attitudes, interpersonal skills and potential of people. Importantly, EI has shown to be predictive of an individual's success in many areas over and above general IQ. A study by Qualter *et al.,* (2012) found that students low on cognitive ability but with high levels of EI performed better than their more cognitively abled students with low levels of EI. Goleman (2001) posits that IQ predicts which profession one can hold a position in, but that EI determines the success of individuals in those positions held. This is particularly evident in the literature on leadership. Many studies now evidence that leaders with distinctive personality characteristics including high levels of EI are likely to be more successful (Barling, Slater and Kelloway, 2000; Rosete and Ciarrochi, 2005) and that more emotionally intelligent leadership styles support communication, encourage flexibility and have been shown to lead to innovative approaches to solving problems (Turner and Lloyd-Walker, 2008).

Leadership includes motivating influencing and bringing about change which is vital in the construction industry and a key success factor in the drive towards sustainability (Ofori and Toor, 2008). Research by Opoku and Fortune (2011) highlights the need for and the potential benefits of committed leadership in the promotion of sustainable practices in construction organizations. Indeed leadership has been identified as a key driver in many of the Government strategies previously mentioned. Taylor (2007) in a study on emergent leaders who act as change agents to promote sustainable urban water management conducted a review of the literature on the same and found that sustainable urban water management champions are likely to have distinctive personality characteristics including high levels of EI. A study by Szekely and Knirsch (2005) which examined the way twenty major German companies measure and report their sustainability performance identified leadership as the most critical success factor that an organization needs to promote and achieve sustainability. Whilst this latter study did not assess EI, the relationship between leadership and the literature indicates that leaders with high levels of EI appear to be critical in driving forward sustainability.

It stands to reason therefore that if emotionally intelligent leaders are more successful, those with high levels of EI should be those at the forefront of the SD and many other Government agendas. Boyatzis (2009) also found that emotional, social and cognitive intelligence competencies predicted effectiveness in professional, management and leadership roles in many sectors of society and states that in addition, these competencies can be 'developed' in adults. The concept of EI derives from social cognition theory which presents the idea that human growth is dynamic and thus subject to change which would indeed indicate that EI can be developed. Including EI in either training or assessment procedures could thus be key to driving the SD agenda forward.

To date not much research has been conducted on leadership within the construction industry and especially not in respect of sustainability. Indeed the understanding of leadership and its relationship to sustainability is still in its primitive stages (Quinn and Dalton, 2009). Much of the literature that does exist has tended to focus on the role of the project manager (PM) however this area of research remains largely unexplored in construction PM (Zhang and Fan, 2013).

A number of authors have suggested that EI may be an important aspect of individual difference that is associated with the skills and competencies necessary for working in and leading projects (Druskat and Druskat, 2006; Leban and Zulauf, 2004; Muller and Turner, 2007). Clarke (2010a) states that EI should play a role in enabling PMs to inspire fellow project workers and generate higher levels of motivation and commitment toward change, which is imperative for sustainability. Studies which have examined the relationship between EI and leadership/PM competencies have found promising results (Butler and Chinowsky, 2006; Leban and Zulauf, 2004; Mount, 2006; Muller and Turner, 2007; Sunindijo *et al*., 2007) and a growing body of literature demonstrates the predictive validity of EI in project outcomes (Turner and Walker, 2008). Two recent meta-analyses (O'Boyle *et al*., 2011; Joseph and Newman, 2010) also provide support for the overall validity of EI in relation to job performance. EI abilities have been found to be associated with the project management competencies of teamwork and conflict management (Clarke, 2010a), team effectiveness (Jordan, *et al*., 2002) and workgroup effectiveness (Druskat and Wolff, 2001). Clarke (2010b) also found that EI ability can be developed in PMs as a result of a 2-day training intervention. The construction PM is a key team member facilitating the construction process through concept, design, operations and commissioning. This entails liaising with clients, consultants and other professionals in financial and organisational management placing the PM in a prime position to influence implementation of sustainable practice. Given the clear link between leadership in construction and the contribution of EI to successful leadership, EI is a worthwhile avenue of investigation for attitude change.

A plethora of research now exists in relation to EI within the workplace in general. Given the positive findings reported in such studies, a body of literature has begun to develop on EI and graduate employability. The discussion surrounding graduate employability focuses on the skills and competencies that employers consider desirable in their graduate recruits, sometimes referred to as 'generic' or 'transferable' employability skills (Bridgstock, 2009) often referred to as 'soft skills'. The recognition of the need for more 'soft skills' in construction such as communication, teamwork, problem solving, decision making and emotional awareness has increased in recent years with the view that traditional skills such as technical and analytical abilities are no longer adequate for overall career success (Mo,

Dainty and Price, 2007). The study by Dacre Pool and Qualter (2013) found ESE to be an important predictor of graduate employability and in addition that graduate employability mediates the relationship between ESE and career satisfaction. In a study assessing EI in construction students, Mo, Dainty and Price (2007) found that these students' score lower on EI compared to other professions. Given the discussion above that EI is potentially a critical factor in construction careers leading to greater leadership success, project success and overall better team working and performance and also in driving the SD agenda forward this is something which needs addressing.

EI and academic success have found to be positively correlated with a considerable amount of research undertaken in this area (MacCann, *et al*., 2011; Di Fabio and Palazzeschi, 2009; Qualter, *et al*., 2012). A recent meta-analysis of 213 U.S. based studies by Durlak, *et al*., (2011) found teaching interventions for social and emotional learning for children (age 5 to 18 years) to be effective in terms of improved social and emotional skills, attitudes, behaviour and academic performance again evidencing that higher levels of EI correspond with more positive attitudes making it a worthy avenue of exploration. Reis and Roth (2010) also found EI to mediate decision making in educational settings.

The case for EI in all aspects of education and employment appears abundantly clear. Assessing EI in higher education is under-researched in the UK, especially in relation to construction (Mo, Dainty and Price, 2007). Potentially EI could be used in construction organisations and HEI to promote better attitudes towards sustainability, improving the performance of managers/leaders and their teams and developing EI skills which have been highlighted to be critically important for leadership.

Pertaining to sustainability, affective capabilities may be extremely important as emotions have ties with caring for the environment. Those that are more in tune with their emotions may therefore have more positive values and beliefs towards the environment and by extension the other pillars of sustainability (Bastian *et al*., 2005; Salovey and Mayer, 1994). It could be argued that the success of EI in all these situations is due to one's SE in being able to use their EI capabilities. Given that a person higher in ESE is more likely to use the ability they have (Kirk *et al*., 2008) it would seem therefore important to not only develop EI skills

but to also encourage and foster SE for the use of these skills and abilities. In particular, developing such abilities in construction students as per the recommendations of Mo, Dainty and Price (2007) would mean that students enter the construction industry equipped with not only the academic skills but also the much called for softer skills to enhance better decision making, better collaboration, better team working and more emotional affinity towards SD. Muller and Turner (2010) in tandem with such recommendations also state that training programs for PMs should expand beyond the traditional methods, tools and techniques, and include more social and psychological training to foster emotional competence and in turn beneficial attitudes. If results from the current study find that those with higher levels of EI have greater positive attitudes towards sustainability, it may be a powerful tool for change in the sustainability agenda in that measuring the same may reveal how best to target attitude change.

The literature review revealed that a number of tools exist for measuring EI (Table 1 below depicts each scale along with what type of EI it measures). However as the purpose of this research was to measure ESE, the Emotional Self-Efficacy Scale (Kirk, Schutte and Hine, 2008) was utilised. Other than the ESE and The Self-Efficacy Questionnaire for Children (SEQ-C, Muris, 2001) which measures three different aspects of self-efficacy (social, academic and emotional), to the author's knowledge, there are no measure which specifically measures ESE as distinct from the measure of EI.

The ESES has four subscales with eight items representing each of the four branches of the Mayer and Salovey (1997) EI model (understanding, perceiving, facilitating and regulating emotions) comprising in total 32 items. The measure is further elaborated on at Chapter 4.

Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) - Mayer, Salovey and Caruso (2002).	Ability EI
Emotional and Social Competency Inventory (ESCI) - Goleman, D (2007)	Mixed model
The Emotional Intelligence Appraisal - Bradberry, T. & Greaves, J. (2005)	Mixed model
The Trait Meta Mood Scale (TMMS) - Salovey, P., Mayer, J.D., Goldman, S.L., Turvey, C. & Palfai, T.P. (1995).	Trait EI
The Assessing Emotions Scale - Schutte, N.S., Malouff, J.M., Hall, L.E., Haggerty, D.J., Cooper, J.T., Golden, C.J. & Dornheim, I.L. (1998)	Trait EI

Bar-On Emotional Quotient Inventory (EQ-i) - Bar-On, R. (1997)	Trait EI
The Swinburne University Emotional Intelligence Test (SUEIT) - Palmer, B.R. and Stough, C. (2001)	Trait EI
Trait Emotional Intelligence Scale (Wong and Law EI Scale (WLEIS) - Law, K. S., Wong, C. S. & Song, L. J. (2004)	Trait EI
Trait Emotional Intelligence Questionnaire (TEIQue) - Petrides & Furnham, (2006)	Trait EI
Self-Efficacy Questionnaire for Children (SEQ-C) - Muris, P. (2001)	ESE
The Self-Efficacy Questionnaire for Children (SEQ-C) - Muris, P (2001)	Aspects of SE

Table 1. Measures of Emotional Intelligence

3.3 Optimism

Optimism is an individual difference variable that reflects the extent to which people hold generalized favourable expectancies for their future (Carver, Scheier and Segerstrom, 2010). A number of psychologists have documented the diverse benefits of optimism and drawbacks of pessimism (Peterson, 2000). Optimism has been linked to subjective well-being particularly in medical contexts, greater persistence toward goals and to better coping and adjustment, perseverance and effective problem solving, academic performance, athletic, military, occupational, and political success, popularity, good health and even to long life. Pessimism in contrast has been linked with depression, passivity, failure, social estrangement, morbidity and mortality, self-defeating patterns such as less persistence, more avoidance coping and health-damaging behaviour (see Peterson, 2000; Sweeny, Carroll, and Shepperd, 2006; Carver, Scheier and Segerstrom, 2010 for reviews).

The concepts of optimism and pessimism have ties to psychological theories of motivation, known as expectancy-value theories. These theories suggest a logical basis for some of the ways in which optimism and pessimism influence people's behaviour and emotions in that optimistic people exert effort, whereas pessimistic people disengage from effort (Carver *et al.,* 2010). If a person is confident (optimistic) about eventual success of a problem for example, effort will be exerted in achieving this success whereas If a person is doubtful (pessimistic) there is a tendency to disengage effort (Carver and Scheier, 2014). Optimism as a motivational state has been said to connect us to a cause (e.g. SD) beyond the connection between the self and the problem, and increases the motivation to approach and master problems as it highlights the possibility of overcoming the problem in question and the value

of doing so (ZuLlow, 1991; Peter and Honea, 2012). In terms of influencing behaviour, Peter and Honea (p271) state that "*In forming a connection with a problem and the cause oriented toward its resolution, knowledge of the problem, perceived accountability for a problem, and sense of responsibility to the cause are necessary but not sufficient triggers to generate action. It is the affective experience associated with that appraisal of accountability and responsibility, not 'cold cognitions', that serves as the impetus for behaviour"* highlighting the importance of both optimism and emotions.

The importance of the overall aim to be achieved has been identified as an important predictor in the actual achievement of that aim. For example optimists have been found to increase goal engagement for high-priority goals leading to attainment of those goals and tend to decrease engagement for low-priority goals and also to display greater engagement in treatment programs where the need for the program is perceived by the person to be important (Geers, Wellman and Lassiter, 2009, Geers *et al*., 2010). Such facts stress the importance of making SD an important goal in the eyes of the construction industry again reinforcing the need to change attitudes.

A diverse range of people work within the construction industry and many different professions have to come together to work on projects thus relationships within industry are an important factor in ensuring the success of a project. An important finding of optimism in this respect is that people with higher levels of optimism tend to work harder at relationships. A study by Neff and Geers (2013) of newlyweds found that optimists engaged in more constructive problem solving than did pessimists, both in a lab discussion of marital issues with their partner, and outside the lab on days when there was relationship conflict. Authors such as Doppelt (2008) postulate that a positive orientation (optimism) is important for sustainability in that people are more likely to succeed in identifying ways of overcoming obstacles, if they hold an optimistic orientation. Thus optimism may be an important factor in industry working together and identifying ways of overcoming the barriers to SD.

An important finding of relevance to SD is that when thinking towards the future, optimists have been shown to generate more vivid mental images of positive events than do pessimists. Studies such as that by Sharot *et al*., (2007) who in a study using brain imaging, found that

there was greater activation of a brain area that is associated with imagining positive future events in participants who had greater dispositional optimism. Such findings have also been corroborated by Blackwell *et al*., (2013) who found associations between greater dispositional optimism and the ability to generate vivid positive mental imagery of the future. Given SD is a very much future orientated goal it is important that we are able to envisage what it is that will be achieved by exerting efforts now to preserve for the future and thus optimism in this respect appears to be an important factor.

Authors such as Corral-Verdugo and Pinheiro (2006), and Joreiman, *et al*., (2001) have found that future-oriented individuals are also pro-environmentally oriented persons. Corral-Verdugo *et al.,* (2009) contend that being future-oriented may imply also being attracted by factors supporting the long-lasting life of the socio-ecological systems. The findings of their research revealed that psychological factors including future orientation, altruism and emotions towards nature form the basis for a pro-sustainability orientation which, in turn, predicts environmentally friendly behaviours. Their findings support the rationale for the current research in examining the roles that emotions may play and the life orientation of individuals. An important distinction has been found in relation to optimism and the environment however. Wenglert and Rosen (2000) created separate measures to assess optimism for a personal future and optimism for a world future to directly compare the two and found that found that people are notably more optimistic for their personal futures than for the world's future. These findings have also been replicated by O'Brien McElwee and Brittain (2009) who state that levels of optimism may differ in this respect due to the attitude objects being different i.e. self versus the world. These finding are important in the context of current research, as SD is fundamentally a worldwide issue yet it affects us individually with each of us being able to assist individually. Authors such as Thorsen (2004), Pappas, (2012) and Murray (2011) all advocate that SD should be looked upon first as a personal issue in order for us to connect with the wider issues, a point which is elaborated upon further at Chapter 7.

Whilst optimism is a personality trait and thus stable over time, ample research (Seligman, 1990, Carver and Scheier, 2014) has shown that people can adopt an optimistic orientation if they choose to do so making it a worthwhile area of research for the present study.

Individual differences in optimism/pessimism can be measured by several scales, all of which share the same underlying conception deriving from the expectancy-value model of behaviour. Table 2 below depicts the various measures that are available and their uses. The Life Orientation Test (LOT) is the most widely used of these measures and was the measure chosen for the current research. This was based on the fact that the other measures are not as widely used as the LOT, and the LOT is relatively shorter in comparison. This would enable the researcher to still obtain valid and reliable results whilst alleviating boredom effects given the other two measures to be completed.

Life Orientation Test (LOT) - Scheier & Carver (1985)
Generalized Expectancy of Success Scale (GESS) - Fibel & Hale (1978).
Optimism-Pessimism Scale (OPS) - Dember, Martin, Hummer, Howe, & Melton 1(989).
The Attributional Style Questionnaire - Peterson et al. (1982)
Content Analysis of Verbal Explanations (CAVE technique) - Peterson et al. (1992)
The Hope scale - Snyder et al. (1991)

Table 2. Measures of Optimism

3.4 Summary

This chapter reviewed the literature pertaining to attitudes and psychological constructs that may be instrumental in changing attitudes toward SD. In conclusion, the literature review established that:

- The presentation of new information can assist to change attitudes. However this in itself may not be enough for long lasting attitude change.

- The interrelatedness of attitude components is complex and a change in one component can result in a change in another, thus taking into account each of the 3 components of attitudes may strengthen attitude change, particularly the affective component.

- Individuals are more likely to exert more effort to scrutinize available object-relevant information when presented with information that is of interest to them.

- There are clear strong links between EI and leadership which is vital for SD.

- People are more likely to succeed in identifying ways of overcoming obstacles if they hold an optimistic orientation with more future-oriented individuals found to be pro-environmentally oriented persons, again extremely important for SD.

- Both of these psychological constructs can be developed in individuals which is extremely promising given the demonstrable links within the SD literature.

4. Research Methodology

Once the literature review had been undertaken and the problems identified, a review of the various methodological approaches was undertaken to identify the relevant methodologies for the proposed research.

There are four main elements in designing a study: philosophical assumptions, theoretical approach, methodology and methods (Crotty, 1998). In order to decide as to the most appropriate design to undertake for the production of knowledge, a researcher must appraise, differentiate and choose between the competing philosophies, theories, methodologies and methods. This chapter presents an overview of the various methodologies and their philosophical underpinnings along with the various methods that can be used in each. Each has been given consideration taking into account the proposed research and the questions that need to be answered and the proposed methodology is outlined at section 4.5.

All research is underpinned by the philosophical positions of ontology and epistemology both of which are fundamental in guiding research (Arghode, 2012). Within each of these philosophical positions sit various theoretical perspectives which also guide the researcher in carrying out the research. The use of terminology for theoretical perspectives varies across the literature with some referring to it as a stance (Crotty, 1998), a worldview (Creswell and Plano Clark, 2011) or a paradigm (Arghode, 2012). These terms are used interchangeably throughout this chapter. Worldviews or paradigms consist of a set of philosophical assumptions, values and beliefs which guide researchers in their inquiries into a research problem (Lincoln, and Guba; 1985; Guba and Lincoln 2005 in Creswell and Plano Clark, 2011). Morgan (2007: p50) describes a paradigm as "*a shared belief system that influences the kinds of knowledge researchers seek and how they interpret the evidence they collect*". They are a way of interpreting or explaining the phenomenon based on prior understanding (Arghode, 2012). Which worldview a researcher decides upon influences the methods that are chosen to investigate the problem in question and collect, analyse and interpret the data (Dainty, 2007).

As stated, two philosophical assumptions underpin all research, that of ontology and epistemology. Ontology is the philosophy concerning the overall nature of what things are and asks the question what reality is and what is the nature of reality (Creswell and Plano Clark, 2011). According to Schwandt (2001: p190), ontology "*is concerned with understanding the kind of things that constitute the world*". It is concerned with identifying, in the most general terms, the kinds of things that actually exist. Examples of ontological questions would be 'what is the nature of the universe?' or 'is there a god? Epistemology is the branch of philosophy concerned with the nature of knowledge itself, the knowledge of knowing or what it is to know (Crotty, 1998) and asks the question how can we know reality? E.g. how can we know the nature of the universe? It is the process of how we go about knowing things and how we separate true ideas from false ideas. In its simplest form, ontology is about what is true, 'that we exist', and epistemology is about methods of figuring out those truths, 'knowing why we exist' (David and Sutton, 2011).

When considering methodology, three approaches have been identified: Qualitative, Quantitative and Mixed Methods. Within each of these approaches there are a number of methods that can be used to capture data and subsequently analyse it which are discussed also. Research design is less known in the built environment than in mainstream social science disciplines (du Toit and Moulton, 2013), however the same principles of 'how' remain the same. All three approaches have their own strengths and weaknesses in their design and application. Which approach should be used when planning a research depends on several factors such as the type of questions asked, the researcher's training or experience, and the audience (Creswell, 2009). All three approaches have been considered as part of the research methodology and are critically reviewed below in order to determine the most appropriate outcome in support of this research.

Once the methodology has been decided upon, in order to guide the process of the research, a particular logic or reasoning must be used which includes inductive, deductive and abductive approaches (Creswell and Plano Clark, 2011, Saunders, Lewis and Thornhill, 2012). It is important to understand the logic of the different reasoning approaches in order to build transparency and consistency into the research as it allows the reader to see the process the researcher undertakes when conducting and analysing the research (Ketokivi and Mantere,

2010). As to which approach is adopted depends on the methodology being used and each is discussed within the methodological approaches below as they apply to each.

4.1 Theoretical Perspectives

The theoretical perspective of a study describes the approach used to explain reality, and is related to a particular epistemology, or way of understanding reality (Crotty, 1998). The choice of which perspective to adopt fundamentally affects the ways in which data are collected and analysed (Dainty, 2007).

4.1.1 Quantitative

Quantitative research invariably adopts a post-positivist epistemology, which posits the existence of an absolute truth that can never be confirmed, only disconfirmed (the concept of falsifiability, Popper, 1959) and is the logic that guides the research. Positivism sees 'observable evidence' as the only form of credible scientific findings and assumes that only facts derived from the scientific method can make legitimate knowledge claims. Slife and Williams (1995) contend that positivist researchers make claims for knowledge based on: 1) determinism or cause and effect thinking, 2) reductionism, by narrowing and focusing on select variables to interrelate, 3) detailed observations and measures of variables and 4) the testing of theories that are continually refined (cited in Creswell and Plano Clark, 2011). Researchers who take this position accept or reject the hypotheses after testing the theory resulting in verification or rejection of the theory in question.

The ontological position of the post-positivist perspective is deeply rooted in realism which posits that reality is singular, i.e. there is only a single truth e.g. there might be a theory that operates to explain the phenomenon of a study (Creswell and Plano Clark, 2011). In the case of this research, ESE might explain attitudes towards SD. Positivism contends that reality is external and is independent of human consciousness in that something exists whether anyone is aware of it or not (Blaikie, 2010; David and Sutton, 2011). It adopts an objective epistemology in that such reality is best measured via objective methods (Grix, 2010). In terms of the reasoning adopted to guide quantitative research, a deductive approach is taken the process of which is elaborated on further at section 4.2.1.

4.1.2 Qualitative

Qualitative research is generally associated with the interpretivist and constructivist paradigms. These perspectives seek to understand and interpret social reality (that is to explain the construction of knowledge and how social experience is created and given meaning) through the understanding or meaning of a phenomenon formed through participants and their subjective views (Grix, 2010; Yilmaz, 2013). Participants provide their understandings of a phenomenon from meanings shaped by their own personal experience of interaction with others (Creswell and Plano Clark, 2011). Qualitative research adopts a relativist ontology which posits that multiple realities exist as opposed to a single reality proposed by post-positivists and a subjectivist epistemology which believes that there is no external reality, but rather we create our reality and understandings through our interactions with each other (Creswell 2009; David and Sutton, 2011). The claim made by this approach that social phenomena are produced through social interactions, implies that events, situations and behaviours, within which these social interactions occur, change over time and are therefore in a constant state of revision (Bryman and Bell, 2003; Yilmaz, 2013) unlike in quantitative research which accepts the absolute truth of an observed outcome. In terms of the reasoning adopted for guiding qualitative research, an inductive approach is utilised, the process of which is explained at section 4.2.2.

4.1.3 Mixed Methods

Mixed methods research has struggled to develop its own corresponding philosophical paradigm (Johnson and Gray, 2010) with pragmatism, transformative–emancipatory, and critical realism all guiding mixed methods research. The premise of the transformative–emancipatory paradigm is that the creation of a more just and democratic society should be the ultimate goal for conducting research (Venkatesh, Brown and Bala, 2013). It places central importance on the experiences of marginalised individuals who suffer from discrimination or oppression (Sweetman, Badiee and Creswell, 2010). Studies using this approach aim to create a political debate and discussion so that change and empowerment will occur (Creswell, 2009). Mertens (2003) contends that it supports mixed methods research due to its ability to address the concerns of diverse groups in an appropriate manner.

Critical realism, a widely used paradigm, does not recognize the existence of some absolute truth or reality to which an object or account can be compared (Bhaskar, 2008) but rather focuses on the contingent relationships between phenomena and structures taking the ontological position that social structures, natural objects, material artefacts, and conceptual entities such as language, opinions, and goals are real and exist independently of our perception of them (Fleetwood 2005). Venkatesh, Brown and Balal (2013) claim that critical realism is an ideal paradigm for mixed methods research because of its acceptance of the existence of different types of objects of knowledge, physical, social, and conceptual, that have different ontological and epistemological characteristics and meaning. In doing so, critical realism embraces various methodological approaches from different philosophical positions allowing a combination of different research methods to be employed in a research inquiry to develop multifaceted insights on different objects of research that have different characteristics and meaning (Venkatesh, Brown and Bala, 2013; Zacharisdis, Scott and Barratt, 2013). Critical realism also emphasises the role of replication in research, contending that research findings should not be generalized unless they can be replicated across samples, populations and research methods with this replication of empirical testing key to establishing their 'reality' (Mir and Watson, 2001).

Pragmatism focuses on the actions and consequences of the research, the primary importance of the question asked rather than the methods, and the use of multiple methods of data collection to inform the problems under study (Creswell and Plano Clark, 2011; Venkatesh, Brown and Bala, 2013) and tends to be the favoured approach in mixed methods research. According to Biesta (2010), pragmatism offers a very specific view of knowledge which claims that the only way we can acquire knowledge is through action and reflection. Knowledge is thus not about the world out there but about the relationship between actions and consequences.

The ontological position within pragmatism accepts that reality may be singular but that multiple realities also exist thus valuing both objective and subjective knowledge. In this respect it is pluralistic and adopts a 'what works' approach drawing on many ideas and diverse approaches to uncover explanations (Creswell and Plano Clark, 2011), embracing the two extremes for mode of inquiry adopted by positivism (quantitative) and interpretivism

(qualitative) for knowledge creation (Pansiri, 2005) The leading epistemological ideas in pragmatism are those of 'belief', 'doubt' and 'habit' (Peirce, 1877 cited in Pansiri, 2005) with both knowledge and social reality based on beliefs and habits which are socially constructed by the processes of institutionalization, legitimation and socialization (Berger and Luckmann, 1967; Yefimov, 2003, cited in Pansiri, 2005). There remains ongoing debate as to the philosophical underpinnings of mixed methods research, however pragmatism has positioned itself as a contending paradigm and has been hailed as the foundation of mixed methods (Teddlie and Tashakkori 2003; Pansiri, 2005). A central idea of pragmatism is that it should be used to address problems and in this respect, Biesta (2010) contends that pragmatism should not be understood as a philosophical position amongst other positions, but as a set of tools that can be used to address such problems especially those created by other philosophical approaches and positions. Indeed Powell (2001: p884) states that "*To a pragmatist, the mandate of science is not to find truth or reality, the existence of which are perpetually in dispute, but to facilitate human problem-solving*".

As mixed methods adopt both quantitative and qualitative perspectives, both inductive and deductive reasoning are utilised, known as 'abduction'. The abductive approach stems from the perception that advances in science neither follow the pattern of deduction or induction, but rather take intuitive leaps resulting in unexpected observations or findings (Taylor *et al*., 2002). In the abductive process, the researcher moves between induction and deduction interpreting individual phenomena, building a theoretical understanding of the problem informed by the context and the participant's language, meanings and perspectives which leads to new insight about existing phenomena by examining these from a new perspective (Kovacs and Spens, 2005; Suddaby, 2006).

4.2 Methodology

Schwandt (2001) defines research methodology as the theory of how inquiry should proceed. It is the way we go about scientific investigations and how we establish scientific knowledge. The methodological dimension of research speaks to the 'how' of the research process, what methodological approach and source of data should be used and analysis of the assumptions, principles, and procedures in a particular approach to inquiry (Schwandt, 2001; du Toit and Moulton, 2013).

4.2.1 Quantitative

Quantitative methodology has been defined as a type of empirical research into a social phenomenon or human problem through the testing of theories consisting of variables which are measured with numbers and analysed with statistics in order to determine if the theory in question explains or predicts the phenomenon of interest (Creswell, 2009). It is useful for answering questions of who, where, how many, how much and what is the specific relationship between variables (Adler, 1996 cited in Frels and Onwuegbuzie, 2013). The main objective of using this approach is to investigate cause and effect or differences between various groups or treatments through testing hypotheses and interpreting the results to determine the probability that the conclusions found among the sample can be replicated within the larger population (Amaratunga *et al*., 2002). Pre-existing theories are used to guide the formation of new hypotheses about relationships that might exist concerning a particular group, topic, or situation. Hypotheses are usually formulated as the research question, and then data are collected and analysed to answer the research question. Measures of statistical analysis are then performed on the data collected from which conclusions are derived with the hypotheses either accepted or rejected based upon the results of the statistical analysis (Creswell, 2009). By definition, the positivist approach to knowledge adopts the logic of a deductive approach, a top down process, moving from theory to hypotheses from which logical conclusions are derived by testing hypotheses, the results of which add to or contradict the theory in question (David and Sutton, 2011). The hypothesis being tested and the phrasing of the research questions govern how data will be collected (i.e., a locally developed survey or experiment) as well as the method of statistical analysis used to examine the data (Creswell, 2009). Methods of quantitative data collection include:

Telephone surveys
Postal surveys
Panel surveys
Longitudinal surveys
Experiments

The advantage of using such approaches is that they allow for large sample sizes to be obtained when conducting research on a broader scale or studying a large number of people,

cases, and situations which is also more cost-effective. Data collected can also be analysed fairly quickly using statistical software (Burke Johnson and Onwuegbuzie, 2004) and can provide a succinct summary of major patterns allowing for other researchers to easily replicate the findings (Patton, 2002). This is also a weakness however as such methods require the participants' perspectives and experiences to fit into pre-determined response categories, which fail to provide insight into the participants' personal experiences (Foor, Walden and Trytten, 2007; Yilmaz, 2013). The feelings, thoughts, frames of reference, and experiences of participants which may have led to the choice of response provided cannot be derived from such methods. Indeed as Dainty (2007) points out, choosing a reductionist approach for examining social phenomena such as a questionnaire survey is likely to distance the enquiry from the social realities of the participant. Research to date has tended to focus on the identification of barriers through survey based approaches offering no insight into how these barriers might be overcome (Brennan and Cotgrave, 2014). This is where qualitative methods can assist or sometimes prevail over quantitative methods.

4.2.2 Qualitative

Qualitative research has been defined as an emergent, inductive, interpretive and naturalistic approach to the study of people, cases, phenomena, social situations and processes in their natural settings in order to reveal in descriptive terms the meanings that people attach to their experiences of the world (Patton, 2002; Denzin and Lincoln, 2005; Creswell, 2013). It is a form of social inquiry that focuses on the way people interpret and make sense of their experiences and the world in which we live. Unlike quantitative studies which are concerned with outcomes, generalisation, prediction, and cause-effect relationships through deductive reasoning, qualitative studies are concerned with process, context, interpretation, meaning or understanding. Qualitative researchers analyse responses in a variety of ways, seeking to find a number of explanations for the phenomena in question (Arghode, 2012). In seeking to uncover these explanations, qualitative research uses inductive reasoning, a bottom up approach, moving from individual perspectives and specific observations to broad patterns and broad generalisations to theories generated from the data collected. The aim is to describe and understand the phenomenon studied by capturing and communicating participants' experiences in their own words (Yilmaz, 2013) providing quotes to illustrate the existence of different perspectives captured (Creswell and Plano Clark, 2011). Thomas (2006:

p238) states that "*the primary purpose of the inductive approach is to allow research findings to emerge from the frequent, dominant or significant themes inherent in raw data, without the restraints imposed by structured methodologies…and to develop a model or theory about the underlying structure of experiences or processes that are evident in the text data*". As qualitative research relies on entirely inductive methods to collect and analyse data, the aim is theory generation developed through the interaction and discussion from individuals and thus there is no theoretical starting point (Creswell and Plano Clark, 2011). However as Dainty (2007) points out, there is no reason why qualitative methods cannot be employed for theory testing as well as theory generation.

Qualitative research data is collected via surveys (open ended questions rather than fixed tick box questions), interviews, group interviews, focus groups, observation or ethnographies (Olds, Moskal and Miller, 2005). The research questions that can be answered by qualitative studies are questions such as: What is occurring? Why does something occur? How does one phenomenon affect another? (Borrego, Douglas and Amelink, 2009). Whilst quantitative data is analysed using statistical/numerical methods, answering qualitative questions requires rich, contextual descriptions of the data thus requiring a more in depth approach and a variety of analytic procedures exist which can be applied to the data to elicit such results. Table 1 below provides an overview of the various analytical methods that can be used to analyse qualitative data.

There are no clearly agreed rules for analysing qualitative data, and distinctions between the different methods are not always clear cut with boundaries often crossed. To try and determine the most appropriate method or methods, a researcher can look to the way each analytical approach addresses the issues (Spencer, Ritchie and O'Connor, 2003) namely:

- The status of the data
- The primary focus of the data
- The way the data are reduced
- The kinds of concepts generated from the data
- The way concepts are applied to the data

- The extent to which data are retained in context
- The place of the researcher in the analytical account

Content analysis	Is a form of textual investigation that involves establishing categories, counting and comparisons of keywords or content followed by interpretation of the underlying context. Quantification is not to infer meaning but usage. Keywords are derived from the researcher's interest or review of the literature. Categories established can represent either explicit or inferred communication (Hsieh and Shannon, 2005.
Thematic/Framework Analysis	Used for identifying, analysing and reporting patterns (themes) within data. Seeks to identify commonalities and differences in qualitative data which then allows the researcher to focus on the relationship between the different parts of the data before drawing descriptive and explanatory conclusions around the themes generated (Gale *et al*., 2013; Braun and Clark, 2006).
Discourse analysis	A form of textual analysis which focuses on the meaning of textual data, the way knowledge is produced through the use of distinctive language (David and Sutton, 2011). Can also focus on what is happening in an interaction in terms of performance, linguistic style and ways in which talk and text set out to convince and compete with alternative accounts (Silverman, 2001).
Grounded theory	A method of inquiry in which researchers develop inductive theoretical analyses from collected data and gather further data to check these analyses. The purpose of GT is theory production from the analyses of the data rather than description or application of existing theories (Charmaz and Bryant 2011, cited in Silverman, 2011)
Interpretative phenomenological analysis	Explores in detail how participants are making sense of their personal and social world, the meanings that particular experiences, events and states hold for participants (Smith and Osborn, 2008)
Phenomenography	An empirically based approach that aims to identify the qualitatively different ways in which different people experience, conceptualize., perceive, and understand various kinds of phenomena (Marton, 1986, 1988, cited in in Richardson 1999)

Table 3. Overview of the various qualitative analytical methods

As with quantitative research, qualitative research too has its weaknesses. One argument is that it is not sufficiently rigorous, lacking in the validity and reliability checks of measurement that quantitative research allows for and does not apply its methods in a systematic, consistent manner to the subject matter (Hagger and Chatzisarantis, 2011). However authors such as Hoaglin *et al*., (1982) and Koro-Ljungberg and Douglas, (2008) argue that qualitative

research 'is rigorous' and involves its own set of data collection and analysis methods that ensure the trustworthiness of the finding (cited in Borrego, Douglas and Amelink, 2009). The list of criteria for the credibility and validity of qualitative data is extensive and beyond the remit of this review. However Yilmaz (2013) provides a comprehensive overview of the same. Bashir, Afzal and Azeem (2008) also discuss reliability and validity of both quantitative and qualitative research in some depth and provide ten possible strategies to enhance the rigour of qualitative research. In particular they draw upon the use of triangulation strategy which is particularly useful when several researchers are involved in analysing the data combining all their understandings and interpretations of the data to come a mutual conclusion on the meaning of the same (Kitto, Chester and Grbich, 2008).

The generalizability of qualitative findings has also been highlighted as a problem within qualitative research. Some such as Hagger and Chatzisarantis (2011: p271), who are quantitative researchers, offer the view that "*generalizability is not the intention of qualitative research, the purpose of qualitative research is not to generalize, but to generate rich observations that provide insight into the psychological processes involved in the individuals experiencing that phenomenon*". Borrego, Douglas and Amelink (2009) echo this sentiment stating that just as rigorous statistical analysis is essential in quantitative research to ensure reliability and generalizability of the results, the rich description of the context and experiences of the participants essential in qualitative research ensures trustworthiness of the data and the results therein. Hagger and Chatzisarantis (2011) also proffer the view that as experiences can be shared, there may be consensus across experiences in specific situations with identical conditions thus providing some potential for generalizability in qualitative research. Indeed how valid it is to draw generalizations can be seen to depend on how meaning attached to the data is conceived and whether it has any reality beyond the context within which it was derived (Lewis and Ritchie, 2003).

The main strength of qualitative research lies in its use of open ended responses which allow the researcher to understand and present the world as it is seen and experienced by the participants. Direct quotations from participants document the feelings, experiences and thoughts about what is happening or has happened on a meaningful level, which as previously stated quantitative research is unable to do.

For many years the quantitative approach has been the predominant method of inquiry, however there has been a growing interest in the use of qualitative methods particularly in the social and behavioural domains. The use of qualitative methods in built environment research is also starting to gain recognition (Amaratunga *et al*., 2002) but remains relatively under-utilised in built environment research. Dainty (2007) in a cross-sectional analysis of research published within *Construction Management and Economics* in Volume 24 (2006) found that research in this field is still overwhelmingly positivist in its orientation, with a subsequent reliance on quantitative methods. Of the 107 papers and notes published in the volume reviewed, 76 used quantitative methods. Only nine used qualitative methods exclusively. In addition, a further 12 papers used a mixed methods approach combining qualitative and quantitative methods. The most popular method adopted was interviews (n16), with relatively few FGs and group interviews (n3) and observation (n2) document or textual analysis (n2) methods being used. Indeed in the researcher's own literature review on attitudes in the construction industry, the majority of research undertaken in this respect also appears firmly rooted within the positivist tradition with most utilising quantitative survey methods.

4.2.3 Mixed Methods

Mixed methods research has been termed the third methodological paradigm (Teddlie and Tashakkori, 2009) and involves collecting, analysing, and integrating both quantitative and qualitative data at some stage of the research process within a single study in order to gain a better understanding of the research problem (Creswell and Plano Clark, 2011). As previously stated, quantitative research is particularly useful for answering questions of who, where, how many, how much, and what is the relationship between specific variables, and qualitative research is useful for answering the what, why and how. Mixed methods research can address both sets of questions providing the depth of qualitative understanding with the scope of quantitative techniques enabling stronger inferences to be made than a single method or worldview (Fielding, 2012; Frels and Onwuegbuzie 2013; Teddlie and Tashakkori 2003, 2009). Interviews, for example can provide depth in a research inquiry by allowing researchers to gain deep insights from rich narratives, and surveys, can bring breadth to a study by helping researchers gather data about different aspects of a phenomenon from many participants.

Typologies of mixed methods research designs include, mixed methodology design where a qualitative phase and a quantitative phase are included in the overall research study and mixed model design where quantitative and qualitative approaches are mixed within or across the stages of the research process.

It is important to make the distinction between mixed method and multi-method approaches here, as although these have been used interchangeably, there are significant conceptual differences between the two. In multi-method research, multiple quantitative methods or multiple qualitative methods are used but they are not mixed thus restricting the research to a single worldview (Creswell and Plano Clark, 2011; Teddlie and Tashakkori 2003, 2009). For instance, a researcher may use participant observation and oral history to study a new implementation in an organization. Another researcher may use ethnography and case study to understand the same phenomenon. In both cases, the researchers are restricted to a single worldview (i.e., qualitative) but employ multiple methods of data collection and analysis (Venkatesh, Brown and Bala, 2013). In mixed methods as is it taken to be here, quantitative and qualitative research methods are used, either concurrently, i.e., independent of each other in which quantitative and qualitative data are collected and analysed simultaneously and then merged for a complete understanding of a phenomenon or to compare individual results; or sequentially i.e., findings from one approach inform the other, in which quantitative and qualitative data collection and analyses are implemented in different phases and each is integrated in a separate phase to understand a phenomenon of interest (Creswell, 2009).

In the concurrent approach, one method may be given priority over another with the one given less priority embedded into the primary method. This process allows both methods to address different sets of questions which answer the overarching research question. For example in an experimental condition, quantitative may answer the outcomes from treatment while the qualitative explores the processes experienced by the group. (Creswell, 2009).

Given the paradigmatic and methodological differences between quantitative and qualitative research approaches, the idea of mixing methods has stimulated much interest and debate

with some who believe that the philosophical assumptions and stances of quantitative and qualitative research prevent them from being mixed (Creswell, 2011). Others however ague that it is feasible to conduct research that blends the philosophical assumptions and stances of quantitative and qualitative research methodologies (Mingers, 2001; Teddlie and Tashakkori 2003, 2009). Advocates of the mixed methods approach argue that the complexity of human phenomena dictates more complex research designs to capture them (Sandelowski, 2000) and that the best answers frequently result from using a combination of qualitative and quantitative techniques (Murray Thomas, 2003). Hagger and Chatzisarantis (2011), quantitative researchers, have recognised the benefits of utilising both approaches and state that in experiencing close contact with qualitative research in their own research, they have developed a greater understanding of what qualitative research entails and its distinctions with their own quantitative designs. As a result of this experience, they suggest that perhaps researchers need to revise their focus and talk of the distinction between the two approaches and support the contention that quantitative and qualitative research can be integrated such that one approach compliments and augments the other.

Creswell and Plano Clark (2011: p45-46) in their review of mixed methods research design also argue that multiple perspectives can be used in mixed methods research and provide a simplistic yet useful overview of how this may be done: if a study starts out with a survey which then follows on with interviews, the researcher is using a post positivist perspective to inform the study at the beginning followed by a constructivist perspective which seeks to explain the survey results. If a researcher collects both qualitative and quantitative data in the same phase of the research and merges the two, then a pragmatic perspective is adopted allowing a pluralist stance to explain the phenomena.

As to how methods can and should be mixed again has created some debate with some arguing that the qualitative element should be given prominence as doing so results in the ability to test representativeness/ generalization, to better locate target populations or define them for in-depth study, to achieve demonstrable reliability and validity, to address inconsistent results, and to deepen our understanding of the research problem (Hesse-Biber, 2010, cited in Fielding, 2012). However it is not necessarily the case that one must be given prominence over the other and both quantitative and qualitative can be given equal status or

one prominence over the other depending on the nature of the research and inquiry. Some of the most eminent researchers in the field (Creswell and Plano Clark, 2011; Mingers 2001; Teddlie and Tashakkori 2003, 2009) agree that that selection of a mixed methods approach should be driven by the research questions, objectives, and context. Amaratunga *et al*., (2002: p30) in writing on mixed method research in the built environment states that:

"There is no uniquely best approach to research, either in the natural world or in the built environment in particular, and the best that can be done is to describe the ways in which research is carried out in a variety of situations. This is not to suggest that a mixed methodology is the only suitable research design, rather that it is an appropriate and, at times, desirable design. The overall choice needs, of course, to be the most suitable to achieve the objectives of the specific piece of research. A mixed methodology, however, has a number of advantages within built environment research, as well as other disciplines, and may be able to enhance the quality of such work".

Whichever way one chooses to mix methods, a clear rationale and a considered research design is needed. Venkatesh, Brown and Bala (2013: p26) state that it is important that researchers understand the appropriateness of mixing methods for 3 reasons:

1. Unlike qualitative and quantitative approaches, a mixed methods approach is typically not a natural methodological choice in social and behavioural sciences Therefore a mixed methods research approach should serve one or more purposes beyond the core purpose of a research methodology (i.e., help researchers conduct scientific research inquiries);

2. An explicit delineation and/or recognition of these purposes by researchers employing a mixed methods approach may help the reader better understand the goals and outcomes of a mixed methods research paper;

3. An unambiguous understanding of mixed methods research purposes will help researchers make informed decisions about the design and analysis aspects of a mixed methods inquiry. If, for instance, the purpose for conducting mixed methods research

is developmental, a sequential mixed methods approach is perhaps more suitable than a concurrent or parallel approach.

The mixed methods approach is not as well established as either quantitative or qualitative but the use of mixed methods research has shown a steady increase since 2000 (Ivankova and Kawamura, 2010) and has evolved mainly because of the complexity of research problems, the legitimisation of qualitative inquiry and the need for more evidence in applied settings (Cresell and Plano Clark, 2011). Despite its apparent lack of prominence, Fry (1934, cited in Johnson and Gray, 2010), actually confirms that that mixed methods has long been advocated as an approach to achieving the best outcome from research:

"The summary of the methods used in Middletown makes it clear that research work usually requires more than proficiency in one particular technique. Time and again the really creative part of a social inquiry is deciding how different approaches should be combined to yield the most fruitful results".

As stated above, mixed method research can be conducted either sequentially or concurrently. In doing so the researcher can use a number of combinations of mixing the methods to carry out research depending on the timing, integration and priority given to the quantitative or qualitative aspect of the research. Creswell and Plano Clark, (2011) however outline six major mixed methods research designs that are most frequently used in the field. Figure 5 depicts the various designs and the way in which they are mixed. The next section of this chapter discusses the chosen methodology and design and provides arguments and justifications for doing so.

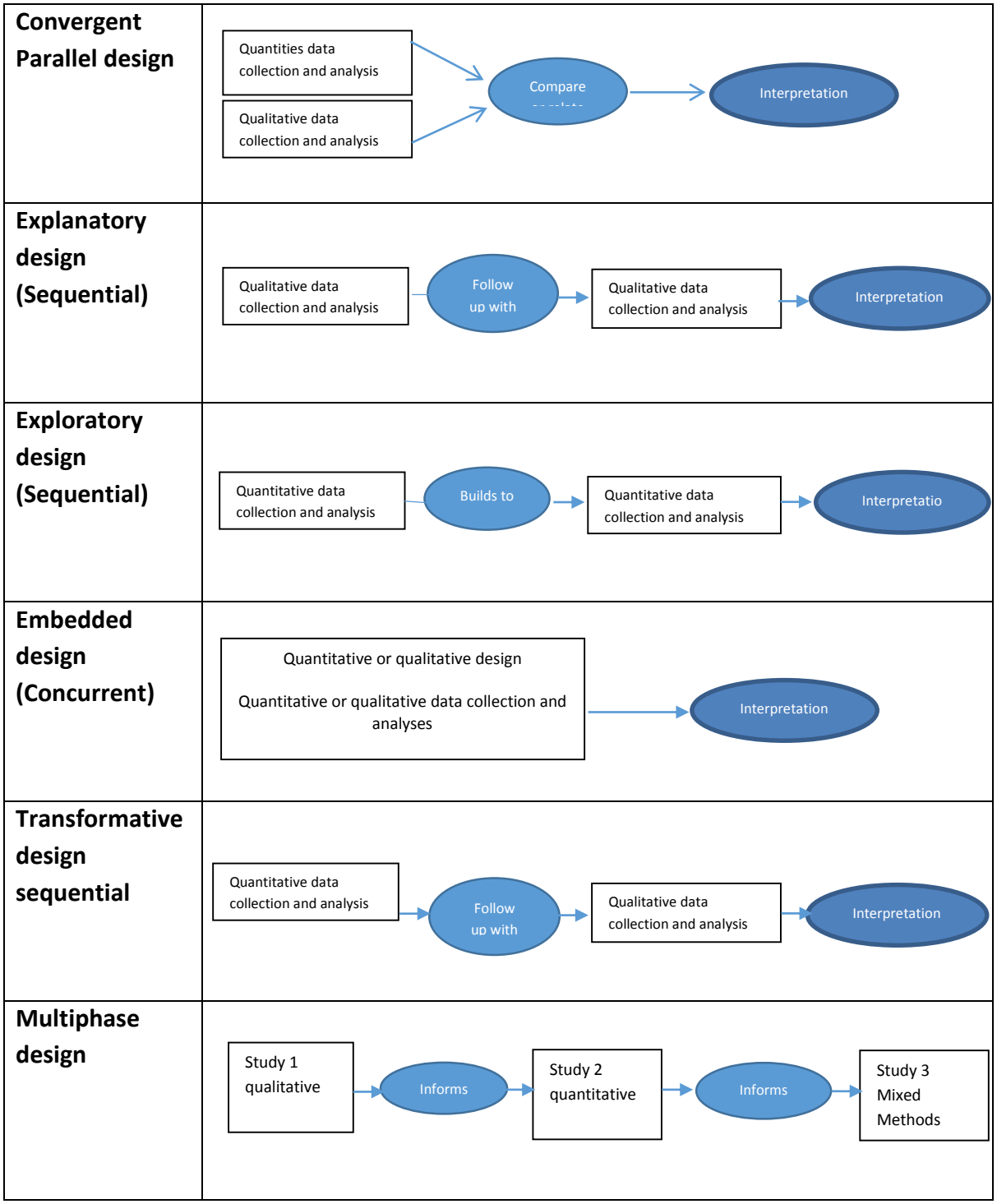


Figure 5. Overview of Various Mixed Methods Designs Approaches (adapted from Creswell Plano and Clark, 2011)

4.3 proposed methodology

When preparing a research study, the researcher needs to justify the use of the chosen approach (Creswell and Plano Clark, 2011). Based on the review of the above methodologies and consideration of the research problem, it was decided that predominantly a concurrent

mixed methodology utilising an embedded design would be applied for the purposes of the current research but that based on the needs of the project, one aspect (Phase 3) would need to adopt a mixed model approach. This decision was made to ensure that the best outcomes from the data collected in each phase were obtained. A pragmatist perspective was followed throughout. The justifications for taking this approach are discussed in more detail below.

The literature review undertaken established that a number of barriers exist towards the adoption of SCPs. This finding needed to be confirmed or refuted for the purposes of the present research. To identify the extent of this across industry, i.e. across a large sample, a way of measuring attitudes towards SD was needed and thus the use of quantitative methods in the form of a survey was deemed the most appropriate to capture this information. The research also sought to investigate what psychological variables may help in eliciting attitude change and again quantitative measures in this respect are the most appropriate method in order to establish whether relationships exist between the two.

As previously stated, such methods however can require the participants' perspectives and experiences to fit into pre-determined response categories, which fail to provide insight into the participants' personal experiences (Foor, Walden and Trytten, 2007; Yilmaz, 2013) potentially missing important information which could be instrumental in answering the research question. Dainty (2007) commented on the lack of qualitative research within the construction management field reporting the many views of others that research methods in the construction industry need to change if researchers are to have an influence on the industry. He highlights Seymore *et al*'s (1997) standpoint that the construction management discipline has underestimated the interpretive process given that most 'objects' in this field of research are people. Whilst this research has not reviewed other disciplines in this respect, the literature review conducted here elicited no papers within which a qualitative approach was undertaken to investigate attitudes towards SD implying that an objectivist stance is very much maintained in this field of research also. The view espoused by Dainty that this impedes contributions to both research and practice in the built environment and that more pluralistic attitudes towards selection of research methods is needed is supported within this research. Akadiri and Fadiya (2013) in their research investigating the role and ability of sustainable development-based requirements (top management commitment, government regulations

and construction stakeholder pressures) as potential determinants of adoption of environmentally sustainable practices, acknowledge the use of purely quantitative methods as a limitation of their findings stating that qualitative research would have allowed for the issues raised to be explored in more depth. Amaratunga *et al*., (2002) also advocate the use of mixed methods in order to enhance the quality of research within the built environment. It was the authors view after consideration of such arguments and the nature of the enquiry to be undertaken that adopting a mixed methods approach was fundamental to eliciting the best responses and obtaining knowledge for attitude change. Capturing more in-depth responses through the use of qualitative methods in the present research will allow for a more detailed understanding of these attitudes, and where they stem from would allow the researcher to target areas for intervention.

As stated back in section 4.1.3, the leading epistemological ideas in pragmatism are those of 'belief', 'doubt' and 'habit' with both knowledge and social reality based on beliefs and habits which are socially constructed by the processes of institutionalisation, legitimisation and socialisation. It is the author's contention that this fits well with the current research based on the premise that many behaviours within the construction industry are based on beliefs and habits which are constructed by the process of institutionalisation. In addition, the nature of this research is social research and thus methods of eliciting rich contextual data to understand the current position as to why the adoption of SCPs remains low is needed. Pragmatism also supports the interventionist approach (Miettinen, 2006) which is the overarching aim of this research to be informed from the qualitative and quantitative findings in phases 1 and 2. In addition Abrahamse *et al*., (2005) state that many researchers report that interventions worked but not necessarily why. It is the contention of the author that adopting a mixed methods approach in relation to the intervention stage of this research is fundamental to understanding the outcomes of the same. If the interventions developed within this research are to be utilised in the future, adopting a pragmatic approach in this stage of the research is critical.

Various ways of conducting mixed methods research exist as depicted in figure 5. Based on the requirements of the research discussed above, a concurrent embedded mixed methods design was predominantly chosen to investigate the research problem. This approach

involves collecting data concurrently, sequentially or both. Data are then analysed with one being given priority over the other, with the secondary data usually acting as supplementary data to enhance the research in some way. Ways that secondary data can enhance the design include informing or expanding upon the quantitative aspect and or informing future interventions (Creswell and Plano Clark, 2011). Data was collected concurrently throughout the research as the quantitative aspect in phase 1 was run for an ongoing duration until the completion of phase 4, whilst the qualitative aspect was conducted separately alongside quantitative data collection. Whilst a quantitative approach is adopted first, priority was given to the qualitative approach undertaken because it focuses on in-depth explanations of the results obtained in the first phase whilst also providing information for the development of the intervention in the final phase 3 of this research (the embedded element of the design). An illustration of this is provided below at figure 6.

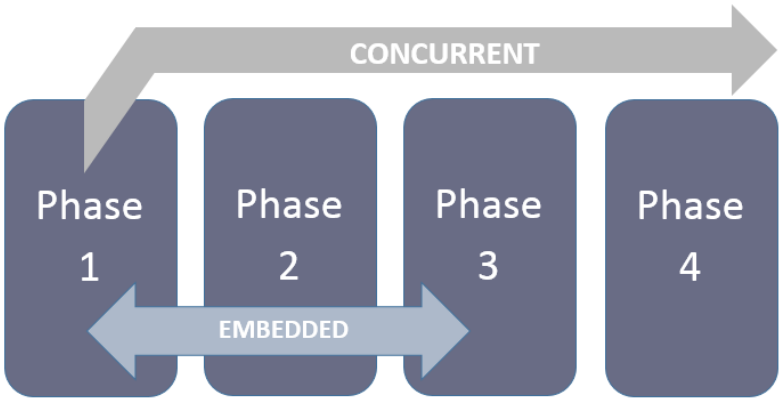


Figure 6. Concurrent embedded design

Upon beginning phase 3 of this research, it became evident that a mixed model approach would be needed to collect and analyse the data. Leech and Onwuegbuzie (2009) state that researchers should thoughtfully create designs that effectively address their research objectives, purposes, and questions. In adopting various mixed methods designs within this research, the author believes that these recommendations have been met and the best methods of addressing and answering the research problem applied. An overview of the choice of method for each phase is provided below with further clarification and expansion in their respective chapters provided.

4.3.1 Phase 1

The first phase sought to gain a picture of attitudes towards SD in the built environment and to investigate whether the psychological constructs of ESE and optimism mediate attitudes towards SD. In order for this to be established, attitudes would need to be quantified to be measured against the psychological variables. From the outset it was also clear that in order to measure the effects of any interventions employed, a way of measuring attitudes would be needed. The need to quantify attitudes led to the development of an attitude measure (The Sustainable Development Attitudes Measure), as at present no 'validated' measure exists. Once the measure had been developed it was piloted amongst built environment students at LJMU along with the psychological measures. After testing for internal consistency and reliability of the SDAM, the analysis of the results revealed that the measure was valid and reliable enabling further data collection to be conducted. In order to establish whether any relationships existed between the SDAM and the psychological variables, correlation analyses were performed on the data. The development and testing of this measure is discussed in detail in Chapter 5. Only ESE correlated with attitudes and thus optimism was dropped from the investigation. The SDAM and ESES were subsequently sent out to 10 universities across the UK for validation purposes. In order to obtain industry responses, the SDAM and the ESES were set up as a survey online through Bristol Online Surveys (BOS). In order to retrieve responses, a social media campaign (Twitter, Linked In and Facebook) was conducted for which ethical approval was granted. Many organisations now use social media as a platform for marketing and various other uses. In particular, governing bodies of construction professionals and other member affiliations also have presence on social media platforms. Given the potential scope of contacts on each of the various platforms, using such methods was seen as ideal. The response rate from industry however was unfortunately poor. Generally sample sizes of 100 and above are needed to be able to make generalizations about the findings. Only 80 responses were obtained rendering the results ungeneralizable to the construction industry and thus no elaborate analyses were performed on this data.

The researcher also wanted to compare results between industry professionals and students to investigate if there were any differences, however again the poor response rate from

industry made this impossible. Details of participant samples, methods of analysis and results of the analysis are provided in detail in Chapter 5.

4.3.2 Phase 2

The purpose of the next phase of this research was twofold. The first objective was to gain an in-depth understanding of attitudes in industry towards SD and how and why these attitudes are formed. The second was to ascertain views from industry professionals as to how they believe we can overcome the barriers identified and move the SD agenda along, promoting the use of more SCPs with a view to pinpointing areas for the intervention. Given the scope and richness of data required, qualitative methods were adopted for this phase of the research. Individual interviews would have been too time consuming and not enough different views elicited to allow for theory or generalizations to develop from the data. Qualitative inquiry in the form of FGs was deemed the best method to collect a lot of rich data in a short space of time.

There are three ways in which FGs can be used in as depicted in fig 6. The chosen method was supplementary (consistent with the concurrent embedded design) as the information was to be used to confirm or refute the findings within the literature review and to inform the development of the interventions in phase 3. This process and the outcomes are discussed further in detail at sections 6.2 and 6.6.

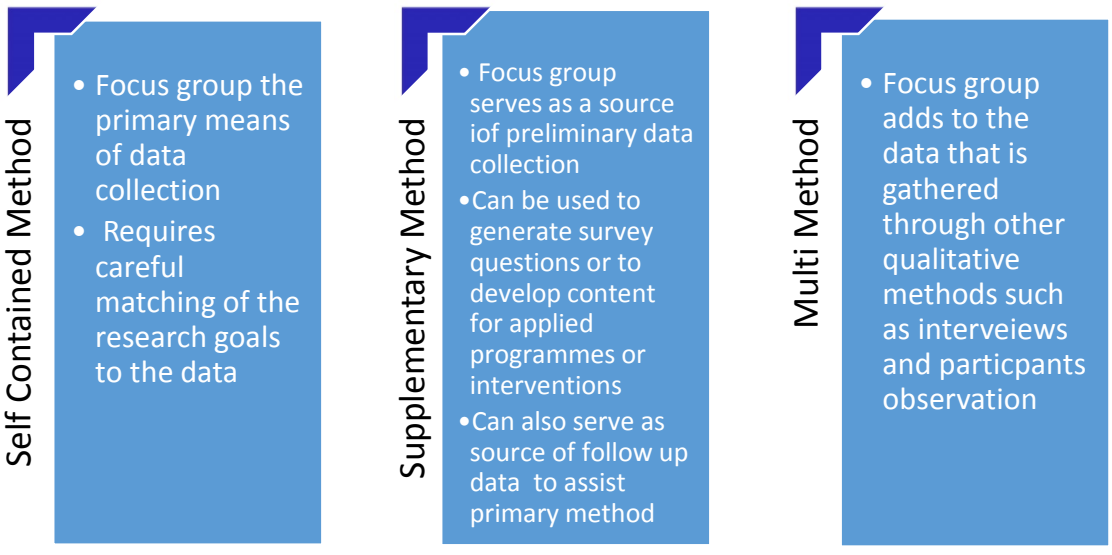


Figure 7. Various uses of focus groups

Four FGs in total were conducted which included a pilot. A discussion guide was drawn up to guide the FG process which was developed and validated with construction industry professionals. Conducting a pilot FG prior to undertaking the actual research was seen as necessary in order for the researcher to familiarise themselves with the process having not previously undertaken such research. Another reason for conducting the pilot was to test out the questions and consider whether they would be suitable for the industry FGs or would need revision. The results revealed that no changes needed to be made to the questions. As the pilot FG was conducted with students, the same also elicited some important views which are included in the results of this phase.

A number of companies were contacted via email and provided with information in relation to the research and asked if they would participate in the study. Three companies agreed and subsequent dates and times were agreed for the researcher to attend their respective premises to conduct the FGs. An assistant FG moderator was used to take notes in case of audiotape failure and to record relevant non-verbal communication. The results from this were also used for triangulation purposes to establish that they and the researcher had come to the same understanding and interpretation of the FG discussions.

As qualitative approaches generally generate huge amounts of data, ways of managing the data are needed. The framework method, a qualitative data analysis method developed by the National Centre for Social Research in the 1980's is a particularly useful tool for achieving this and can be achieved through the use of computer programmes such as NVivo which was adopted for the current research. A thematic analysis as described in table 1 was employed to the data to create a number of themes which would become the focus of the discussion. A full and detailed description of the analysis procedure and the tools used to achieve this is provided at Chapter 6.

The themes that emerged from the findings corroborated the literature review findings supporting the feasibility of this research. In terms of informing the development of interventions, no such information was forthcoming other than SD needs to be driven through education and/or legislation or by client demand. This was a theme that emerged across all FGs and which resulted in the researcher undertaking the development of an educational

intervention to be implemented with LJMU built environment students in phase 3 of the research.

4.3.3 Phase 3

This phase involved the designing and implementation of an educational intervention aimed at eliciting attitude change towards SD. To develop the intervention, a thorough review of the various teaching methods was conducted so that the best methods for eliciting attitude change could be adopted. The previous review of attitudes and attitude change (Chapter 3) was also consulted to inform the various psychological aspects that would need to be targeted. Based on the reviews, a workshop booklet was developed containing six tasks that would take students through a specific process, the development of which is detailed in Chapter 7. The interventions were implemented in semester 1 as one-off sessions within a number of built environment modules. This phase adopted the mixed model approach in which quantitative data was collected pre and post intervention and qualitative data collected through open ended questions within the workshop booklets. Both quantitative and qualitative analysis techniques were utilised to analyse the outcomes of this phase supporting the mixed model approach.

Attitudes were measured pre and post intervention using the SDAM. T-tests were performed on the SDAM which confirmed that the intervention had positively impacted on student attitudes. In an attempt to provide some explanation as to why the intervention was successful, the contents of the workshop booklets were analysed. This phase therefore adopted both quantitative and qualitative approaches. Given that the booklets contained six distinctly different tasks, a pragmatic approach was adopted in analysing the data using both content analysis and phenomenography sequentially throughout the analytic process. Where quantitative measures could be used to provide some numeric meaning to data this was also applied. Table 4 below briefly outlines each task and the method and analysis applied. Again a full and detailed account of the participant samples, methods of analysis and results of the analysis are provided in detail in Chapters 7 and 8.

Task Description	Methodology	Analysis Applied
Task 1 – this task provided students with a list of 6 popular definitions of SD from which they could choose or they could provide their own definition if none of those provided fitted with their understanding of the term. This task was designed to be a 'priming task with the aim of getting students to take 10-15 minutes to think about what sustainability means to them.	Qualitative/ Quantitative	Content
Task 2 – Students were presented with 10 photographs each depicting different issues and challenges concerned with SD. Students were asked to think about each picture and rank them in terms of their importance for SD with 10 being least important and 1 being the most important and write a short description of what they thought each picture depicted.	Qualitative/ Quantitative	Content/statistical (Ranking)
Task 3 – Two circles were presented, one relating to poverty and the other to pollution. In the first circle pertaining to poverty, students were asked to imagine their concern about the issue is large but that their influence is small. They were asked to discuss as a group the things they 'can't' do and place them in this circle. In the second circle pertaining to pollution, students were asked to imagine that their concern is less but that they believe their influence is large. Again they were asked to discuss as a group the things they 'can' do and place them in this circle.	Qualitative	Content
Task 4 – This task involved students to explore and think about what values they care about and why. Students were presented with another circle in which they were asked to write down what they care about most starting from the centre and working their way outwards.	Qualitative Quantitative	Content/statistical (Independent Samples T-Tests)
Task 5 – This task asked students to write about how they think the built environment is important for SD and how in their professional roles they could and would incorporate SD.	Qualitative	Phenomenography
Task 6 – The final task asked students to reflect on the activities undertaken in the workshop and provide their thoughts on the same.	Qualitative	Phenomenography

Table 4. Outline of each of the intervention tasks and the methods of analysis deployed

4.3.4 Phase 4

The final phase of this research sought to validate the educational intervention that was developed in phase 3. A FG was held with four consultants who work within the construction industry and who develop materials for interventions with their clients. Participants were presented with the workshop booklet and provided with a synopsis of the development and

results of the intervention. The researcher gave an overview of the aim of their participation in the validation FG and then an overview of the overall research, before proceeding to describe the intervention and the outcomes.

Once the participants had reviewed the materials, they were asked to provide their feedback as to the following points on the material content in terms of suitability for industry use:

- Is the level of the material appropriate for industry use?
- Are the tasks suitable for an industry context?

No in-depth analysis was adopted in this phase, but rather the researcher took a pragmatic approach providing a descriptive account of the issues highlighted therein with a word cloud (Figure 17) providing an illustrative account of the what needs to be considered for achieving change within an industry context.

4.4 Materials

4.4.1 Sustainable Development Attitude Measure

This is an instrument that was developed by the researcher for the purposes of this research and is discussed in Chapter 5.

4.4.2 Emotional Self-Efficacy Scale (ESES) Kirk, Schutte and Hine (2008)

ESE is measured by the Emotional Self-Efficacy Scale (ESES) developed by Kirk, Schutte and Hine (2008). The scale comprises of 32 items, with eight items representing each of the four branches of the Mayer and Salovey (1997) EI model. Therefore the ESES has four subscales which pertain to understanding, perceiving, facilitating and regulating emotions. Questions 1, 3, 4, 5, 7, 14, 15, 18 assess understanding, 2, 6, 9, 10, 12, 20, 26 assess perceiving, 8, 11, 21, 22, 24, 25, 27, 32 assess facilitating and regulating emotions is assessed by questions 13, 16, 17, 19, 23, 28, 29, 30, 31. Participants are required to rate their confidence in respect of each item by selecting a number on a five-point scale, with a '1' indicating 'not at all confident' and a '5' indicating 'very confident'. Whilst there are four subscales to the ESES studies using the scale have tended to utilise the overall score to measure individuals' overall ESE. This is the

proposed method for this research with scores above the midpoint of 70 indicating high levels of EI.

Kirk, Schutte and Hine reported that reliabilities for the four subscales ranged from.79 to .54 with .92 for overall reliability of the scale.

4.4.3 Life Orientation Test (LOT) Scheier and Carver (1985)

The LOT is a self-report measure that consists of eight items and four filler items deleted in the calculation of a total score. Of the eight included items four are phrased in a positive way e.g. "*In uncertain times, I usually expect the best*" and four in a negative way e.g. "*If something can go wrong for me, it will*". Negatively phrased items are reversed before scoring. Responses are made on 5-point Likert scales with response options ranging from 0 (strongly disagree) to 4 (strongly agree). Scheier and Carver (1985) reported a Cronbach's alpha of 0.76 and a test-retest correlation of 0.79 over a 4-week period.

4.4.4 Focus Group Discussion Guide

Chapter 6 describes the creation of a discussion guide to steer the FGs in phase 2 of the research. The questions were developed from the literature review previously undertaken and a further search to identify key issues relating to SD with a focus to answering the research problem. The questions were then put to an expert in sustainability who approved the same. The draft discussion schedule was then presented to a FG expert who advised that the schedule contained too many questions and that they should be reduced to reflect topics for discussion rather than a list of questions. The guide was subsequently revised and is provided at Appendix 5).

4.4.5 Sustainable Development for Construction and Property Students Introductory Workshop Booklet

This is the workshop activity booklet developed for phase 3 of the research the development of which is discussed at Chapter 7 with the full booklet provided at appendix 12.

4.5 Summary

- The use of a mixed methodology approach to data collection and analysis has been deemed to be usable in both built environment and educational research projects and is thus appropriate for this research.

- In the three main phases of data collection, both qualitative and quantitative data has been collected and analysed separately and complementarily.

- The research adopted a pragmatic approach throughout utilising the most appropriate methodology and methods therein in order to gain the most from the inquiries conducted to generate knowledge.

- Phase 1 adopted a purely quantitative approach utilising a survey and established psychological measures for data collection.

- Phase 2 employed a purely qualitative using FGs as a method of data collection for interpretive inquiry.

- Phase 3, adopted a mixed model approach utilising both qualitative and quantitative methods to analyse the outcomes of the intervention.

5. Phase 1 Investigating Relationships between SD Attitudes and Psychological Variables

Phase one of the research was to investigate methods of eliciting attitude change towards SD in the built environment. As identified in Chapter 3, ESE and optimism look like promising avenues of exploration in achieving this aim.

Attitudes are a latent construct and cannot be observed directly (Milfont and Duckitt, 2010). Thus, rather than being measured directly, attitudes have to be inferred from overt responses (Himmelfarb, 1993). Methods of attitude measurement can be broadly organized into direct self-report methods (such as questionnaires/interviews) and implicit measurement techniques (Krosnick, *et al.,* 2005). For the purposes of the current research a questionnaire approach was deemed the best method to capture the data required.

It is well documented in the literature and here that sustainability cannot be achieved unless the economic, social and environmental dimensions are all taken into account. Whilst a number of instruments exist which measure environmental attitudes, a thorough literature review identified that no validated measure exists which measures attitudes towards the other domains of SD, namely the social and economic aspects and not in a construction context. A previous attempt has been made in this regard by Kokkarinen (2012) who developed the Sustainable Attitude Scale, however the scale has never been validated and given the low reliabilities of the scale and its subscales it was not deemed suitable for use in the present study.

5.1. Questionnaire Development

In order to ensure a strong theoretical grounding, items were developed from the literature and existing measures. A total of 71 items were pooled (Appendix 1) and placed into subscales representing the three dimensions of sustainability (environmental, social and economic) that would be relevant to construction. A fourth scale 'other' was created to encompass important political issues pertaining to SD.

5.1.1 Content validity

Content validity is a non-statistical type of validity that involves "*the systematic examination of the test content to determine whether it covers a representative sample of the domain to be measured*" (Anastasi and Urbina, 1997: p114). In order to ensure content validity, only items that were deemed to be relevant to SD were considered. Content validity is usually conducted via a panel of experts in the domain being investigated (Rattray and Jones, 2007). As such, the list was emailed to 10 experts, 5 from LJMU and 5 professionals in industry currently undertaking the MA in Sustainability at LJMU. Experts were asked to assess the content, relevance and clarity of the statements and provide their comments on the same. In addition they were asked to rate the item on a scale of 1-5 with 1 being weak and 5 being strong.

The 71 questions were whittled down to 28 based on the ratings and feedback for each item. To ensure students were engaging with the questionnaire and not just 'ticking boxes', three of the statements were given an opposing statement. These were statement numbers 6/21 and 12/23. Items 3, 15, 18, 24, and 28 were negatively phrased and reverse scored in an effort to reduce response bias. A sample of questions is provided in Table 3 below with the full questionnaire pack provided at Appendix 3.

5.1.2 Scale Response

When measuring attitudes, Likert-type scales are most commonly used which measure levels of agreement/disagreement. Such scales assume that the strength/intensity of experience is linear, i.e. on a continuum from strongly agree to strongly disagree, and makes the assumption that attitudes can be measured. Respondents may be offered a choice of five to seven or even nine pre-coded responses with the neutral point being neither agree nor disagree (Rattray and Jones, 2007). A 5 point Likert scale was chosen for the current scale. Whilst it is not ideal for respondents to answer neither agree or disagree, if this option is removed it can force respondents to choose a response, which may lead to respondent irritation and increase non-response bias (Burns and Grove, 1997 cited in Rattray and Jones, 2007) and as such this response option was left in. In order to avoid boredom effects, the scale was designed to take no more than 10 minutes to complete.

5.1.3 Hypotheses

Based on the literature review, it was hypothesised that:-

1. There would be a positive relationship between ESE and attitudes to SD
2. There would be a positive relationship between optimism and attitudes to SD

Environment
• The construction industry has an extremely important role to play in the protection of the environment • Modern science and technological advancements will not solve our environmental problems • The impact the construction industry has on the environment has been exaggerated
Social
• Using more resources than we need for the built environment is a serious threat to the health and welfare of future generations • Communities can significantly benefit from sustainable development • Sustainable development can contribute to the reduction of poverty
Economic
• Companies that are environmentally sustainable are more likely to be profitable over the long run • Unless costs savings can be evidenced and achieved, construction industry will not adopt sustainable practices • Humans do not have the right to damage the environment just to get greater economic growth
Other
• The Government should be leaders in sustainability and the environment • Sustainable development does not require that businesses behave responsibly • Sustainability is impossible to achieve so we (the construction industry) should just carry on with normal practice

Table 5. Example questionnaire statements classified by sub-scale

5.1.4 Pilot study

Pilot studies are a crucial element of a good study design. Conducting a pilot study does not guarantee success in the main study, but it does increase the likelihood as they provide the opportunity to test where the main research project could fail, or whether proposed methods or instruments are inappropriate or too complicated (van Teijlingen and Hundley, 2001). As the SDAM is a new instrument, a pilot was run in this instance in order to test the validity and

reliability of the SDAM and also as a feasibility study to investigate the potential relationship between the SDAM and the psychological variables.

5.1.4.1 Sampling and descriptive statistics

When piloting a questionnaire, a sample size of 300 is generally deemed best however sample sizes of 200 plus are acceptable (Rattray and Jones, 2007). The SDAM was piloted to 230 built environment students at LJMU along with the LOT and the ESES through purposive opportunity sampling. The researcher contacted various module leaders and requested to attend at the beginning of lectures to disseminate the questionnaires in person to ensure a good response rate (Appendix 2). Participants were instructed prior to completing the measures that it was important if possible to avoid ticking middle boxes and that if they were veering towards a more negative or positive response to tick boxes demonstrating this. Undertaking such a strategy obtained a good response with only 6 of the questionnaires omitted from the analysis due to too many incomplete items or entire scales not being completed leaving a total of 226 usable questionnaires giving a response rate of 98.5%.

Tests of normality were performed in order to assess whether parametric or non-parametric tests would be needed to analyse the data. Kline (2005) recommends that the skew and kurtosis indices should not exceed an absolute value of 3 and 10 respectively. Levels of normality were met across all scales indicating excellent levels of distribution.

Unfortunately the demographic section was only partially or not completed at all in some cases, and so figures for age and gender are not accurate. Descriptive statistics indicate that of those who did complete demographics, 178 were male and 29 female (n207) with ages ranging from 18 to 48 and a mean age of 23 years (sd = 5.7, n = 170).

5.1.4.2 First Validation of the SDAM

A good questionnaire must have good validity and good reliability. Validity is concerned with the extent to which an instrument measures what it is intended to measure (Tavakol *et al.,* 2008; Bryman and Cramer, 2001). Reliability is concerned with the ability of an instrument to measure consistently (Tavakol *et al.,* 2008). The SDAM was put through rigorous statistical

and non-statistical procedures in order to ensure a robust measure was created. These processes and outcomes are reported below.

5.1.4.3 Inter-item Correlations

Items should inter-correlate at a significant level if they are measuring aspects of the same thing, in this case sustainable development. Any items that do not correlate at a 5% or 1% significance level should be excluded. Correlations for the SDAM revealed that all individual items correlate significantly with each other as do the subscales (Table 6).

	Environmental Subscale	Social Subscale	Economic Subscale	Other Subscale	SDAM Total
Environmental Subscale	1				.74**
Social Subscale	.54**	1			.86**
Economic Subscale	.37**	.52**	1		.74**
Other Subscale	.45**	.68**	.53**	1	.84**

Table 6. Correlations between subscales of the SDAM (pilot study) *Correlation is significant at <0.05 level **correlation is significant at <0.01 level (one-tailed)

5.1.4.4 Reliability

An important aspect of a psychometrically developed measure is the reliability of the scale and its subscales. Chronbach's alpha is used to test for internal consistency of scales. Different authors have differing views on what are acceptable alpha levels for measures. Bryman and Cramer (2001) posit that if items show good internal consistency, Cronbach's alpha should exceed .7 for a developing questionnaire and .8 for a more established questionnaire. Hair and Anderson (2010) however posit that for exploratory research, levels of .6 are acceptable. Reliability for the SDAM was .87 overall indicating that the scale has excellent reliability for an exploratory measure. Alpha scores for the subscales were all acceptable except the economic subscale which was just below the acceptable level required (.53). Item total statistics indicated that if item 10 was dropped this would bring the subscale to a reliable level of .60. However given that the study was to be replicated, item 10 was left in until all data had been collected. All final reliabilities are provided in table 7 below.

	Chronbach's Alpha (α)
SDAM Total	.87
Environmental Subscale	.60
Social Subscale	.74
Economic Subscale	.52
Other Subscale	.78

Table 7. Reliability Coefficients for the SDAM and subscales (Pilot Study)

5.1.4.5 Correlations for SDAM, LOT and ESES

As the purpose of this research is to investigate whether psychological traits mediate attitudes towards SD, the next step was to see whether the SDAM correlated with either of the psychological constructs as hypothesised. Mean scores for the ESES, the SDAM and its subscales were all above their midpoint indicating that the majority of students had above average levels of emotional intelligence and also that attitudes towards SD were generally positive. Standard deviation results indicated good levels of dispersion across all measures (Table 8).

Scale	Minimum Score	Scale Midpoint	Maximum Score	Mean	SD
SDAM	28	84	140	103.11	13.48
Environmental Subscale	7	21	35	25.00	4.11
Social Subscale	7	21	35	26.61	4.31
Economic Subscale	7	21	35	23.74	3.84
Other Subscale	7	21	35	27.76	4.59
ESES	32	96	160	118.31	16.25
LOT				27.62	5.37

Table 8. Descriptive statistics for SDAM, ESES and LOT (pilot study)

On the social and other scales, the majority of students tended to agree more with these statements choosing agree or strongly agree, whereas scores for the economic and environmental subscales were more split which may reflect the reliability of the scales. Indeed students agreed with more statements on the 'other' scale than the other three which may reflect the high reliability of this subscale with more students choosing neither agree or disagree for the economic subscale than any other which again may reflect this scale having

the lowest reliability. One explanation for this may be that as attitudes are formed as a result of our knowledge and experiences (Murray, 2011), given the pilot was with students, it may be that they couldn't relate to this aspect of SD as they have no experience of the same. In order to see if this assumption held true, this subscale was left in for the replication study.

The SDAM correlated with the ESES but not the LOT (Table 9). Further analysis indicated that the LOT correlated with the economic and the other subscales however, and that despite the ESES correlating overall with the SDAM it did not correlate with the environmental subscale. As such hypothesis 1 was accepted and hypothesis 2 rejected. One explanation for the ESE not correlating with the environmental subscale may be as per the findings of Wenglert and Rosen (2000) and O'Brien and Brittain (2009) that people may hold positive orientations for their own future but that this does not extend to a world future.

	SDAM	Env	Social	Eco	Other
ESE	.113*	-.044	.142*	.113*	.142*
LOT	.089	-0.75	.090	.133*	.131*

Table 9. Correlations for ESES LOT and SDAM and its subscales (Pilot Study) *correlation is significant at <0.05 level **correlation is significant at <0.01 level (one -tailed)

5.2 Replication Study

In order to further validate the SDAM and test whether the findings of the pilot study are generalizable to a wider audience of built environment students from across the UK, a replication study was conducted.

5.2.1 Procedure, sampling and descriptive statistics

Fifteen universities were contacted via telephone and email (Appendix 4). Principal lecturers on relevant built environment courses were invited to help disseminate the questionnaires to their students during lectures with 10 of these institutions agreeing to do so. The questionnaires were sent via post with return envelopes. 184 questionnaires were returned. After removing questionnaires with uncompleted questions, a total of 173 usable questionnaires were left for data analysis. This data was added to the pilot data for overall analysis resulting in a total sample size of 399.

Of the 399 cases, full demographic data was not available and so figures for age and gender are not accurate. Descriptive statistics indicate that of those who did complete demographics, 297 were male and 48 female (n = 345) with ages ranging from 18 to 50 and a mean age of 22.47 years (sd = 5.48, n = 312).

5.2.2 Hypotheses

Based on the literature review and the results from the pilot, it was hypothesised that there would again be a positive relationship between ESE and attitudes to SD.

5.2.3 Inter-item Correlations

Correlations for the SDAM for the validation study revealed that all individual items again correlated significantly with each other as did the subscales (Table 10).

	Environmental Subscale	Social Subscale	Economic Subscale	Other Subscale	SDAM Total
Environmental Subscale	1				.73**
Social Subscale	.51**	1			.83**
Economic Subscale	.36**	.48**	1		.72**
Other Subscale	.41**	.55**	.41**	1	.79**

Table 10. Correlations between subscales of the SDAM (replication study) *Correlation is significant at <0.05 level **correlation is significant at <0.01 level (one-tailed)

5.2.4 Reliability

Reliability for the SDAM maintained a high reliability overall of .81 indicating that the scale has excellent reliability. Alpha scores for the environmental and economic subscales however dropped below the acceptable level required (Table 11). Item total statistics indicated that if item 10 was dropped from the economic subscale this would bring the subscale to a reliable level of .51 and that dropping item 12 for environmental would bring the level to .49. Again upon further inspection of the data, this appeared to be due to the majority of students tending to agree more with statements on the social and other subscales and scores for the economic and environmental subscales being more split again.

	Chronbach's Alpha (α)
SDAM Total	.81
Environmental Subscale	.48
Social Subscale	.69
Economic Subscale	.43
Other Subscale	.63

Table 11. Reliability Coefficients for the SDAM and subscales (replication Study)

All means for the SDAM, its subscales and the ESES were again above their midpoints highlighting that levels of ESES were above average and that attitudes towards SD were generally positive. Again standard deviations indicated good levels of dispersion across all measures (Table 12).

Scale	Minimum Score	Scale Midpoint	Maximum Score	Mean	SD
SDAM	28	84	140	102.40	11.65
Environmental Subscale	7	21	35	24.86	3.63
Social Subscale	7	21	35	26.73	3.93
Economic Subscale	7	21	35	24.20	3.60
Other Subscale	7	21	35	26.61	4.07
ESES	32	96	160	118.78	16.46

Table 12. Descriptive statistics for SDAM and ESES (replication study)

5.2.5 Correlations for SDAM, LOT and ESES

As hypothesised, the SDAM correlated with the ESES (Table 13) with this correlation increasing significantly. The economic and the environmental subscales also increased, however the correlation between the ESE and environmental subscale was still not significant. Both the social and the other SD subscales decreased however the correlations were still significant.

	SDAM	Env	Social	Eco	Other
ESE	.136**	.011	.139**	.157**	.104*

Table 13. Correlations for ESES with the SDAM and its subscales (replication study) *correlation is significant at <0.05 level **correlation is significant at <0.01 level (one -tailed)

5.3 Industry

5.3.1 Procedure

Once it was evidenced that the measure was valid and reliable, the next step was to undertake an evaluation of industry attitudes and whether the findings above held for this population. It is well documented in the literature that survey research elicits poor responses (Cotgrave, 2008). If the questionnaire were to be emailed to potential respondents it was deemed this would not generate enough responses for a robust enough statistical analysis to be performed to provide any meaningful results. Increasingly social media is becoming a platform where professionals network and a tool which professional bodies use for marketing purposes. This was seen by the researcher as an opportunity to use as a platform for the promotion of this research. Ethical approval was sought by the LJMU Ethics Research Committee to advertise the research on the social media platforms Linked In, Twitter and Facebook. The researcher is familiar with all of these platforms utilising them not only for personal use, but for work purposes also and is thus competent in the use of the same. A campaign was carried out whereby the researcher posted the link to the SDAM and ESES which was set up on BOS. Whilst email is not the most responsive method, the study was campaigned through the researcher's place of employment via the newsletter which is emailed monthly to subscribers who all work in the industry.

In order to obtain a range of responses across the various professionals within the construction sector, various professional bodies and other relevant groups were targeted through their accounts on the above media platforms such as the RICS, CIOB, RIBA, ICE, and the NFB. Other relevant groups such as Constructing Equality and individual companies were contacted on Twitter ranging from small individual architects to large contractors such as Laing O'Rourke, Mott McDonald, AECOM and Skanska.

5.3.2 Hypotheses

It was hypothesised based on the findings from the above studies, that there would be a positive association between ESE and attitudes amongst the construction professionals' population.

5.3.3 Results

Despite numerous media campaigns over a number of months and the survey being on BOS for over a year, and also being advertised in the researcher's company newsletter, only 83 usable responses (out of 98) were elicited from the hoped for 500, giving a response rate of 16.6%. The poor response form industry further emphasises the barriers that exist in industry towards making progress. Indeed it may be the case that these respondents completed the questionnaire because they have an interest in SD whereas those that saw the questionnaire and chose to ignore it might be more representative of those with less positive attitudes towards sustainability. It may also be the case however that industry are generally inundated with such surveys and generally choose to ignore them whether interested or not as previous research also demonstrates poor response rates to surveys (Cotgrave, 2008). The results are reported below.

5.3.3.1 Inter-item Correlations

Correlations for the SDAM revealed that the SDAM correlated significantly with all of the subscales however two of the subscales did not correlate with each other (Table 14).

	Environmental Subscale	Social Subscale	Economic Subscale	Other Subscale	SDAM Total
Environmental Subscale	1				.81**
Social Subscale	.50**	1			.76**
Economic Subscale	.49**	.30**	1		.69**
Other Subscale	.53**	.52	.50	1	.85**

Table 14. Correlations between subscales of the SDAM (professionals study) *Correlation is significant at <0.05 level **correlation is significant at <0.01 level (one-tailed)

5.3.3.2 Reliability

Reliability for the SDAM maintained a high reliability overall of .72, again way above acceptable levels for a developing measure. Reliability scores for the environmental and economic subscales however were again below the acceptable level required (Table 15). Item total statistics indicated that if item 6 was dropped from the economic subscale this would bring the subscale to a level of .16 and that dropping item 12 for environmental would bring

the level to .36. Both of these levels are still problematic suggesting that these items are causing problems with the internal consistency of the scale. In the case of the economic scale, where there is a negative coefficient, this can sometimes be due to the coding of the data where there are items that are worded in opposite directions to alleviate response biases, as is the case here with questions 6 and 21. Upon inspection of the data there were no problems with the coding, however responses were somewhat polar with a split on those agreeing with 6 or 21. However where one agrees with 6, the opposite response should be provided for 21 and vice versa. Upon inspection of the data, this was not the case with some respondents seeming to indicate that whilst "*humans do not have the right to damage the environment just to get greater economic growth*", they were unsure as to whether "*It is all right for humans to use nature as a resource for economic purpose*" and vice versa, perhaps indicating some problems with the wording of the question causing the low reliability of this scale.

	Chronbach's Alpha (α)
SDAM Total	.72
Environmental Subscale	.11
Social Subscale	.60
Economic Subscale	-.48
Other Subscale	.54

Table 15. Reliability Coefficients for the SDAM and subscales (professional study)

All means for the SDAM, its subscales and the ESES were again above their midpoints highlighting that levels of ESES were above average and that attitudes towards SD were generally positive. Again standard deviations indicated good levels of dispersion across both measures (Table 16).

Scale	Minimum Score	Scale Midpoint	Maximum Score	Mean	SD
SDAM	28	84	140	106.93	8.79
Environmental Subscale	7	21	35	24.78	2.82
Social Subscale	7	21	35	28.57	2.88
Economic Subscale	7	21	35	24.83	2.16
Other Subscale	7	21	35	28.75	3.34
ESES	32	96	160	118.55	15.43

Table 16. Descriptive statistics for SDAM and ESES (professionals study)

5.3.3.3 Correlations for SDAM and ESES

Despite good levels of dispersion, 8.79 and 15.43 respectively, there was no significant relationship between overall attitudes and ESE for the professional cohort. Further inspection of the subscales revealed that there was a significant relationship between the economic subscale and ESE but not the other subscales. Therefore the null hypothesis was accepted in this instance. The finding of a relationship between the economic subscale and ESE is somewhat surprising, particularly in light of the low reliability of this subscale. On the other hand however, economic expansion provides wealth which enables us to deal with environmental, social and global concerns and thus it may be that participants viewed the economic dimension from this perspective. However again given the low reliability of the scale, the results should be taken cautiously.

	SDAM	Env	Social	Eco	Other
ESE	.09	.11	.032	.29**	.06

Table 17. Correlations for ESES with the SDAM and its subscales (professionals study) *correlation is significant at <0.05 level **correlation is significant at <0.01 level (one -tailed)

5.4 Summary

- There was a positive association between ESE and attitudes towards SD amongst the student population and these results have been generalized to a wider population. These findings are extremely promising in light of the pursuit of efforts to drive sustainability, particularly given the clear links between EI and leadership, an essential factor for SD implementation.

- There was a positive association found between the economic subscale and ESE indicating that those with higher levels of ESE tend to favour protection of the environment over economic gains and see SD as a way to be profitable and drive economic growth.

- Given the relatively small sample size of the professional cohort, further research needs to be undertaken within an industry context to establish whether this finding holds true within the wider population.

- There was no positive association between the LOT and the SDAM in the initial study indicating that this is perhaps not a worthwhile avenue of exploration.

- The reliability levels calculated for the SDAM using Cronbach's alpha indicated that the measure is valid and reliable and also that these results were held consistent when generalized to a wider population both within a student and professional context.

- This is an extremely important development given that no validated measure currently exists to measure SD attitudes in a construction context. The measure will be influential in assessing attitudes and in finding ways of changing those attitudes which are not favourable to the SD agenda.

6. Phase 2 Focus Group Data Collection

This chapter discusses the implementation and findings of phase two. Whilst the literature review identified that industry performance is poor in relation to SD and that a number of barriers augment this, it was deemed necessary to collect primary data from industry in order to confirm or refute the results of the literature review to assess the feasibility of PhD research in this area. In addition, given the main aim of this research is to develop an intervention tool aimed at achieving attitude change in industry, phase two also sought to elicit information as to how HE may contribute to this. The purpose, methodology, process and the results are described and a summary is provided.

6.1 Phase 2 objectives

The objectives of phase two were to:

1. To complement and expand on data identified in the literature review.
2. To gain a more in depth understanding of knowledge and understanding of SD and what the drivers and barriers towards implementation are
3. To gain insight into how industry thinks HE can help to achieve change within industry

6.2 Method

In order to elicit participants' perceptions, insights and attitudes in relation to SD and how HE can help in achieving SD within the construction industry, a qualitative approach adopting FG methodology was selected as the appropriate method for data collection.

The advantages of using FGs over other methods of data collection as a method of enhancing discernment of particular phenomena were alluded to in Chapter 4. The overarching decision for using this method of data collection was however that firstly they produce different types of information such as personal, impersonal, shared or unshared information and are suitable for a range of research purposes, particularly in social sciences (Fern, 2001) and that they allow quick access to large numbers of people and promotion of interaction and exchange of ideas within a flexible structure (Morgan, 1997). Given the breadth and scope of the construction industry and the amount of information required for the purposes of the research, conducting individual interviews would have been far too time consuming and

would not have, in the researcher's opinion, provided the rich data needed for the aim of this research.

The various uses of FGs were described back in Chapter 4 and were illustrated in figure 7. As stated, a supplementary method was adopted whereby the information gathered from the FGs would be used to inform/refute the findings from the literature review in Chapter 2, and also to inform the development of the interventions in phase 3 of the research.

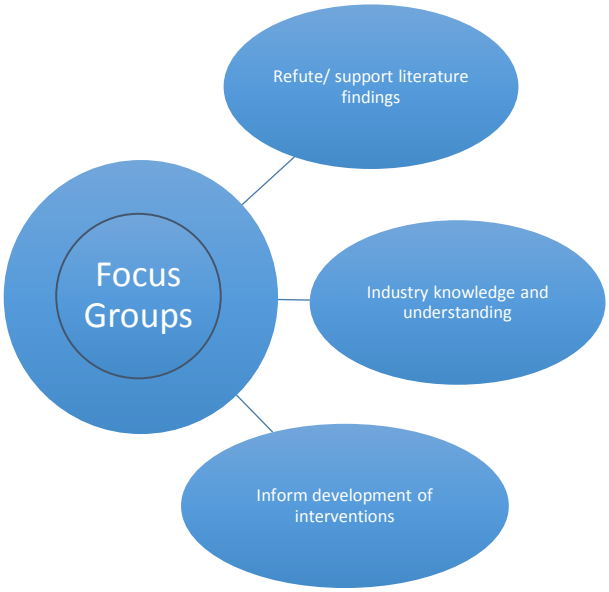


Figure 8: Objectives of conducting the focus groups

6.3 Data Collection

A discussion guide (Appendix 6) was used to generate dialogue on issues relevant to the research aims. Barbour (2005) states that time spent developing a pilot topic guide should pay dividends in terms of its capacity to encourage discussion, thus a thorough and rigorous process was undertaken to ensure maximum benefit from the guide was achieved.

Questions were developed from the literature review previously undertaken and a further search to identify key issues relating to SD and approved with an expert in sustainability. Once a draft discussion schedule had been developed the researcher met with a FG expert to assess

the suitability of the same. It emerged that initially too many questions had been drawn up and that the wording needed to be changed in order to elicit appropriate responses. In accordance with the literature on the structuring of topic guides, 5 main 'topic' questions were developed and subtopics and key words within those topics were listed alongside to be referred to during the FG as prompts (Morgan, 1997). Open ended rather than closed questions were drafted as this method elicits more useful responses and opinions from participants. A summary of the 5 main topic questions is provided below (Table 18).

1. Knowledge – what they actually know about sustainability
What do you understand by the terms SD?
2. Own perceptions of Sustainability
What would you say has informed your perceptions of SD? (What's influenced them – how did they get there – how did they come about these perceptions?)
3. Perceptions of how they think industry is adopting sustainability
What are your thoughts about the construction industry and SD?
4. What they think would change perceptions towards sustainability
What do you think would help to change peoples' perceptions of sustainability and for industry to adopt more sustainable practices?
5. How do you think education can help (in industry)
Is research useful? Greater collaboration between HE's and Industry? Is feedback important?

Table 18. Focus group discussion guide main topics

The final discussion guide was approved with the expert in sustainability before being piloted with a group of architecture students who are taught sustainability on their modules, the process of which is discussed at section 6.4.

6.4 Pilot Focus Group

Pilot studies are a crucial element of a good study design (van Teijlingen and Hundley, 2001). Before conducting FGs, it is prudent to test the schedule with a pilot focus group (PFG) to ensure that the questions are understood and appropriate responses elicited. What is learned from the PFG can be a very useful vehicle for the identification of any problems with questions such as the way they are worded and does the group understand the questions easily for example. Learning from early sessions, especially a pilot, allows for improvement in quality of output in later sessions (Greenbaughm, 2000) and provides the researcher with a clear definition of the focus of the study (Frankland and Boor, 1999). Holloway (1997: p121) also states that piloting is useful if "*the researcher lacks confidence or is a novice, particularly when using interview technique*". Indeed the researcher is not converse in the application of FG methodology and as Twohig and Putnam (2002: p298) point out, "*although many focus group guides and textbooks are useful they are not a substitute for reflexive practice*".

6.4.1 Sampling and recruitment

Generally it is recommended that FGs comprise between six and ten participants (Morgan, 1997; Greenbaum, 2000, Fern 2001). For groups where the participants are very knowledgeable about the topic at hand, smaller group numbers are preferred as large numbers of very knowledgeable people on a particular topic often prove difficult to manage (Morgan, 1997). Conversely where participants are not very knowledgeable on the topic at hand, it is preferable to have more participants in the group so as to generate more discussion (Fern, 2001; Morgan 1997). It was anticipated that the target groups for this research would not be experts on SD, particularly the PFG participants, and that knowledge between the groups would differ. Taking this into account and given the lack of moderator experience on the researcher's part, a maximum sample size of six participants per group was chosen for the study.

When recruiting participants it is important that they share similar experience and characteristics to the topic at hand so that they feel more confident in providing their views, and are able to provide more in depth responses (Fern, 2001; Knodel, 1993; Sim, 1998). Thus recruiting participants in groups from their particular place of employment rather than having

participants mixed from different places of employment was seen as the best mode of deployment for recruitment.

6.4.2 Recruitment of Pilot Focus Group Participants

Ethical approval was obtained from the university ethics committee prior to commencement. An email (Appendix 7) was sent to the programme leader of Architecture and Design who forwarded it on to 3 module codes with a response rate of 8. 6 of these were chosen to take part in the FG with only 5 actually attending. All were architecture students comprising of 2 level 1 students, 2 level 2 students and 1 level 3 student.

All participants were provided with an information sheet (Appendix 8) and prior to commencing the FG, participants were asked to complete a consent form confirming their agreement to participate and have the interview recorded.

The discussion guide was largely followed with additional questions asked where relevant, in response to participant dialogue. The moderator interrupted discussion to clarify a particular point or to re-direct if participants were providing commentary on issues not relevant to the study.

6.4.3 Pilot Focus Group Data Analysis

Analysis of the FG audio revealed that no changes needed to be made to the questions. It was clear that the students answered in a way that was relevant to the question and where they had no knowledge of the topic in question they stated so. There was only one question "*are you aware of the 3 dimensions of sustainability*" that all participants could not answer. This however was not problematic as to have no awareness is an indicator that knowledge is lacking in education and possibly also in industry on this matter. This finding indicated that the question needed to be left in as the purpose of the FG when being conducted with professionals is to investigate their knowledge and understanding of SD, of which the 3 dimensions of SD are an important aspect. Pertaining to the other questions, knowledge and understanding varied depending on the level the student was at but all had something relevant to say on issues presented and attitudes towards the same were clear from the

answers provided. Therefore, it was expected that the questions would elicit similar if not much richer and broader answers from those within industry.

After analysing all FGs it was clear to the researcher that the content of the PFG data was relevant to the outcomes of this research and was included in the reporting of the main findings described below.

6.5 Main Focus Group Study

6.5.1 Sampling and Recruitment

Initially it was intended to target the architectural profession given the importance of the design stage for SD. However as the research progressed it became clear that it was useful to obtain data from a range of professions to establish whether the findings in the literature hold true across industry and also that this might provide a richer information base for the development of the interventions given the different perspectives that each group would potentially come from. Given the breadth and scope of the construction industry, a random purposeful sampling strategy was deemed the most appropriate method. This type of sampling strategy is used when there is a very large pool of potentially information-rich cases and no obvious reason to choose one case over another.

Typically FG studies have as a minimum three FGs and as many as several dozen groups in larger scale studies. An important factor to consider for the number of FGs to conduct is the availability of participants (Morgan, 1997). One FG would not be sufficient for the purposes of this research as was stated previously, it was intended to gather information from a variety of sources so as to establish whether the findings in the literature hold true across the various sectors of the construction industry and also that this might provide a richer information base for the development of the interventions. Given this and the limited scope of this research, it was agreed with the researcher's supervisors that three FGs would be sufficient and that if the aims of the FG were not achieved, time permitting, another FG would be conducted.

Ethical approval was obtained as above. Through the researcher's employment, a number of possible contacts within the construction industry were contacted via email (Appendix 9). The email briefly outlined what the research is about and what would be required of them in

participating. It was stipulated that 5-6 participants would be required for the FG. A participant information sheet (Appendix 8) was also attached to the email. In total, 3 firms agreed to participate in the FG sessions which, as stated above, was sufficient for this research. The groups represented different industry sectors providing variability within the sample and the opportunity to explore diverse perspectives.

Researchers need to be flexible with regard to where FGs are held in order maximise participation (Barbour, 2005). As such it was outlined in the recruitment email that the researcher could attend the premises of participants if this was more convenient for them. Subsequently all FGs were held at the participants' place of work for convenience as requested. Table 19 below shows the groups by profession/subject.

PFG	FG1	FG2	FG3
Architecture students	Mixture of construction professionals	Civil Engineers	Architects

Table 19. Focus group participants by profession

6.5.2 Procedure

Prior to commencing the FG, participants were asked to provide their consent to participate and have the FG recorded. They were then given a brief overview again of what the research was about. Each FG lasted approximately 1 hour.

An assistant FG moderator (Krueger, 1998) was used to take field notes (in case of audiotape failure) and to record relevant non-verbal communication.

To ensure that quality data was recorded and make the analysis process more effective, participants were asked to speak clearly and one at a time so that all views and opinions could be expressed clearly. They were also asked to switch off any devices so that this did not interrupt the recording and affect the quality of the same. They were informed that the FG would be a discussion and that the role of the moderator would be to facilitate the same. They were advised that the discussion would focus on a number of topics (as set out in the topic/discussion guide) but that they could discuss their answers between themselves rather

than direct their answers back to the moderator. It was made explicitly clear that any information provided would be completely confidential and anonymous.

After the participants had left the room, the moderator and assistant moderator had a brief break and then commenced a 15-minute debrief session involving discussion of overall impressions, key quotes and ideas.

6.5.3 Data Management and analysis

Data management is the storing and organising of data whilst data analysis is the systematic process of sorting and classifying data that has been collected (Green *et al*., 2007). Qualitative analysis generally follows a common set of principles: transcribing the interview/FG recording; immersion within the data to gain detailed insight into the phenomenon under investigation; developing a data coding system and linking these codes to form overarching themes (Morse and Richards, 2002, cited in Smith and Firth, 2011). As outlined in the methodology chapter, a thematic analysis was applied to the FG data.

Thematic analysis is a method for identifying, analysing and reporting patterns (themes) within data and follows the given set of principles as outlined above. It minimally organizes and describes a given data set in rich detail. The thematic analysis approach seeks to identify commonalities and differences in qualitative data which then allows the researcher to focus on the relationship between the different parts of the data before drawing descriptive and explanatory conclusions around the themes generated. Unlike many other forms of qualitative analysis, the thematic approach does not sit within any particular theoretical approach or epistemological viewpoint (Gale *et al*., 2013) and through this theoretical freedom provides a flexible and useful research tool which can provide rich and detailed accounts of complex data (Braun and Clarke, 2006). Such an approach very much aligns with the researcher's pragmatic approach to the research in being able to adopt various methods to reach the objectives of the research. Indeed through this theoretical freedom, thematic analysis is able to provide a flexible and useful research tool, which can potentially provide a rich and detailed, yet complex, account of data (Braun and Clarke, 2006).

Whilst a variety of qualitative approaches to analysis exist, Braun and Clarke (2006) argue that thematic analysis should be seen as a foundational method for qualitative analysis and Boyatzis (1998) characterizes it, not as a specific method, but as a tool to use across different methods. The practice of thematic analysis provides the researcher with core skills that are useful for conducting many other forms of qualitative analysis with the 'thematising' of meanings being one of the few shared generic skills across qualitative analysis (Holloway and Todres, 2003).

As qualitative approaches generally generate huge amounts of data, ways of managing the data are needed. The utilisation of computer programmes such as ATLAS /ti and NVivo have been well documented (see Lewis 2004; Creswell, 2013 for reviews). Creswell (2013) highlights the advantages of using such programmes in that they:

- Provide a quick and easily accessible filing system to store and organise the data;
- Support the research by locating and searching specific statements, a phrase or a word
- Encourage the researcher to focus carefully on the macro level such as text lines, meaning, sentences and ideas
- Enable to map and visualise relationships between codes, themes and documents

NVivo 10 was chosen as the most appropriate management programme. NvVivo is software that helps to easily organise and analyse qualitative information (QSR International, 2011). More importantly, it also allows the Framework Method (FWM) a type of thematic network, to be applied within the programme through the utilisation of the framework matrix function. Where thematic analyses seek to unearth the themes salient in a text at different levels, the thematic network (FWM) aims to facilitate the structuring and depiction of these themes (Attride-Stirling, 2001).

The FWM originated in social policy research and is most commonly used for the thematic analysis of semi-structured interview transcripts. Given the similarity of the data to be used i.e. FG transcripts, and that the FWM sits within the analysis methods of thematic analysis such a method is absolutely appropriate in the current research. In addition, the FWM is not

aligned with a particular epistemological viewpoint or theoretical approach and is therefore able to be adapted to inductive, deductive and abductive approaches which fits with the researcher's pragmatic approach taken with this research (Gale *et al*., 2013).

Critical to data analysis is the process of examining the information collected during the FGs and transforming it into a coherent account of what was found (Green *et al*., 2007). Using the FWM not only assists the researcher in guiding the stages of data analysis helping develop the skills required to undertake vigorous qualitative data analysis, particularly for the novice researcher (Smith and Firth, 2011), it also allows researchers to explore data in depth while simultaneously maintaining an effective and transparent audit trail, enhancing the rigour of the analytical processes and the credibility of the findings (Ritchie and Lewis, 2003). The procedure of how the data was analysed and managed is set out below.

6.5.3.1 Analysis Procedure

The FWM provides clear steps to follow during the analytic process which lead to the production of structured outputs of summarised data (Gale *et al*., 2013). These steps are depicted below at figure 9. Each of the steps and the processes undertaken during each step is described in detail below.

The FG recordings were downloaded from the handheld recorder to the computer and transferred to a CD Rom ready for transcription. For the purposes of time saving, two of the recordings were sent to an external transcriber and the remaining two were transcribed by the researcher. Each FG recording was transcribed verbatim, however to comply with anonymity as was conveyed to participants, where names and company names have been used that may otherwise reveal the participants themselves or the companies they work for, these have been replaced with 'NAME' and 'COMPANY NAME'. The analysis of the data actually starts during the FG (Gale *et al*., 2007) and thus each transcript was supplemented with notes made during the FG for triangulation purposes.

Once the FGs had been transcribed, the first step was for the researcher to familiarise themselves with the dialogue again which involved total immersion in the data reading and re-reading again. Each transcript was thoroughly read and re-read whilst simultaneously

listening back to the recording to become familiar with the whole data set. Listening to the recording whilst simultaneously reading the transcripts helped the researcher to ensure that all language and text was understood properly and nothing misinterpreted as tone and meaning cannot be derived from text alone. All transcripts were checked for errors during this process.

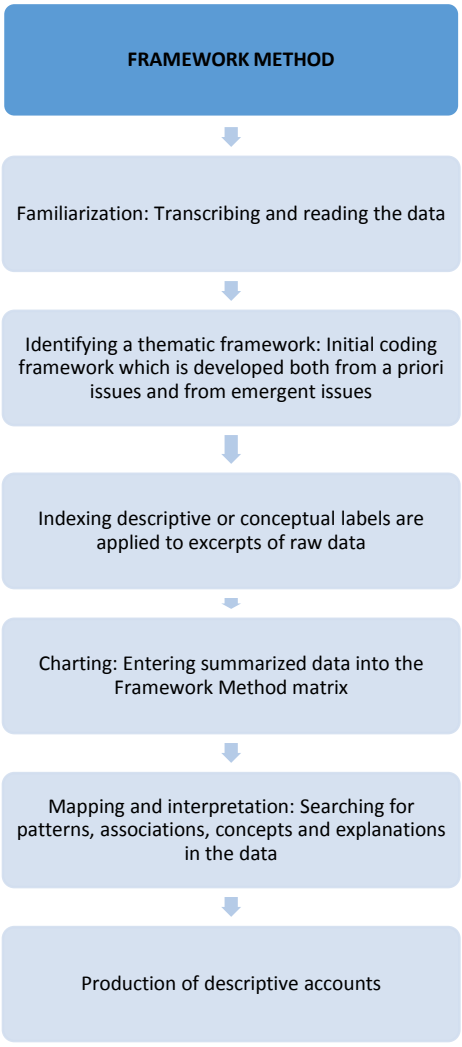


Figure 9: Framework analysis Process (adapted from Srivastava and Thomson, 2009)

The next step was to begin coding the transcripts. Coding involves carefully reading the transcripts line by line and applying a code or label which describes what the researcher has deemed important in that particular passage. The process of coding line by line is important as it can highlight important aspects of the data which might otherwise be invisible because it is not clearly expressed or does not fit in with the rest of the account it is highlighted within

(Gale *et al.,* 2013). The aim of the coding process is to 'classify' all of the data so that it can systematically be compared to other parts of the data (Gale *et al*., 2013). As previously described, an abductive approach was taken, moving between both inductive and deductive approaches during the analytic process. This allowed the researcher to identify predefined codes aligned with the original objectives of this phase (deductive) and also to identify new concepts arising from the data from both the perspectives of each individual and the groups (inductive). It is during this coding process that the researcher recognises emerging themes or issues and the thematic framework is identified. These emerging themes or issues can also arise from a priori themes (deductive) however it is at this stage that the researcher must allow the data to dictate the themes and issues (inductive). To achieve this, the researcher then uses the notes taken during the coding process (Srivistava and Thompson, 2009). Relevant segments of text were highlighted and comments made in the right hand margin to describe the content of each passage with a label or code. This ranged from only a few words, to parts of sentences or whole paragraphs. Notes and ideas, for example questions to bear in mind as the analysis proceeded, and ideas for explanations or patterns in the data were also made during the coding process.

The process of refining, applying, and refining the developing analytical framework was repeated until no new codes were generated. The outcome of the coding process is to create three to eight themes, which capture the key issues, concepts and themes that have been expressed by the participants in the raw data and which are assessed to be the most important themes given the research objectives (Thomas, 2006). This then creates the analytical framework to work within. The final framework consisted of four overarching themes.

The transcripts were then imported to NVivo10 and the analytical framework was applied to each transcript and the process of indexing began. The researcher systematically went through each transcript, highlighting meaningful passages of text and selecting and attaching an appropriate code from the final analytical framework. Using the NVivo software, the segments of data were indexed using what are known as 'nodes'. A numerical system is used within NVivo for indexing references where each 'node' is given a number. Within this indexing system a hierarchy can be created in which the nodes are placed numerically into

the overarching theme so that the lower level codes sit within each overarching theme as demonstrated in figure 10 below.

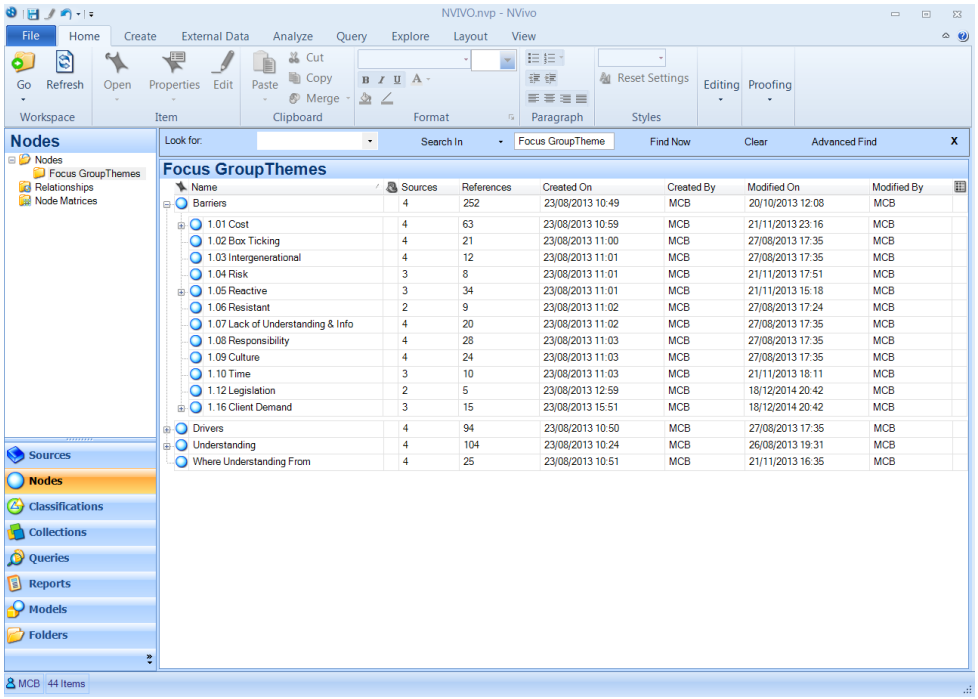


Figure 10: NVivo Coding Process

Upon completion of indexing the transcripts in the analytical framework, the process of charting began. Charting involves summarising the data by theme from each transcript. It is important that whilst the data must be summarised, the original meaning is not lost. The data was summarised firstly in NVivo using the framework matrix function. The matrix comprised of one row per FG and one column per theme. Data was abstracted from the transcripts for each FG and summarised using verbatim words and inserted into the corresponding cell in the matrix. The matrix was then exported to excel so that it could be formatted. An excerpt of the matrix is provided at Appendix 11.

Mapping and interpretation of the summarised data was then undertaken. This final stage involved the analysis of the key characteristics as laid out in the matrix in which the researcher searched for commonalities between each data set and highlighting any patterns or associations emerging from the data. The concepts and associations arising from the analysis of the data are reflective of the participant and therefore, any strategy or recommendations made by the researcher should echo the true attitudes, beliefs, and values of the participants

(Srivistava and Thompson, 2009). The final stage in the analysis process is then to report the results of the analysis through the provision of rich descriptions based on the summarised data around the overarching themes which were generated.

6.5.3.2 Results

Four high-level themes were developed from the FG analysis with a number of subsequent mid-level themes. Figure 11 provides a thematic model of the high-level themes and their associated mid-level themes. Each theme is described collectively with reference to each FG and quotations provided to support the findings presented.

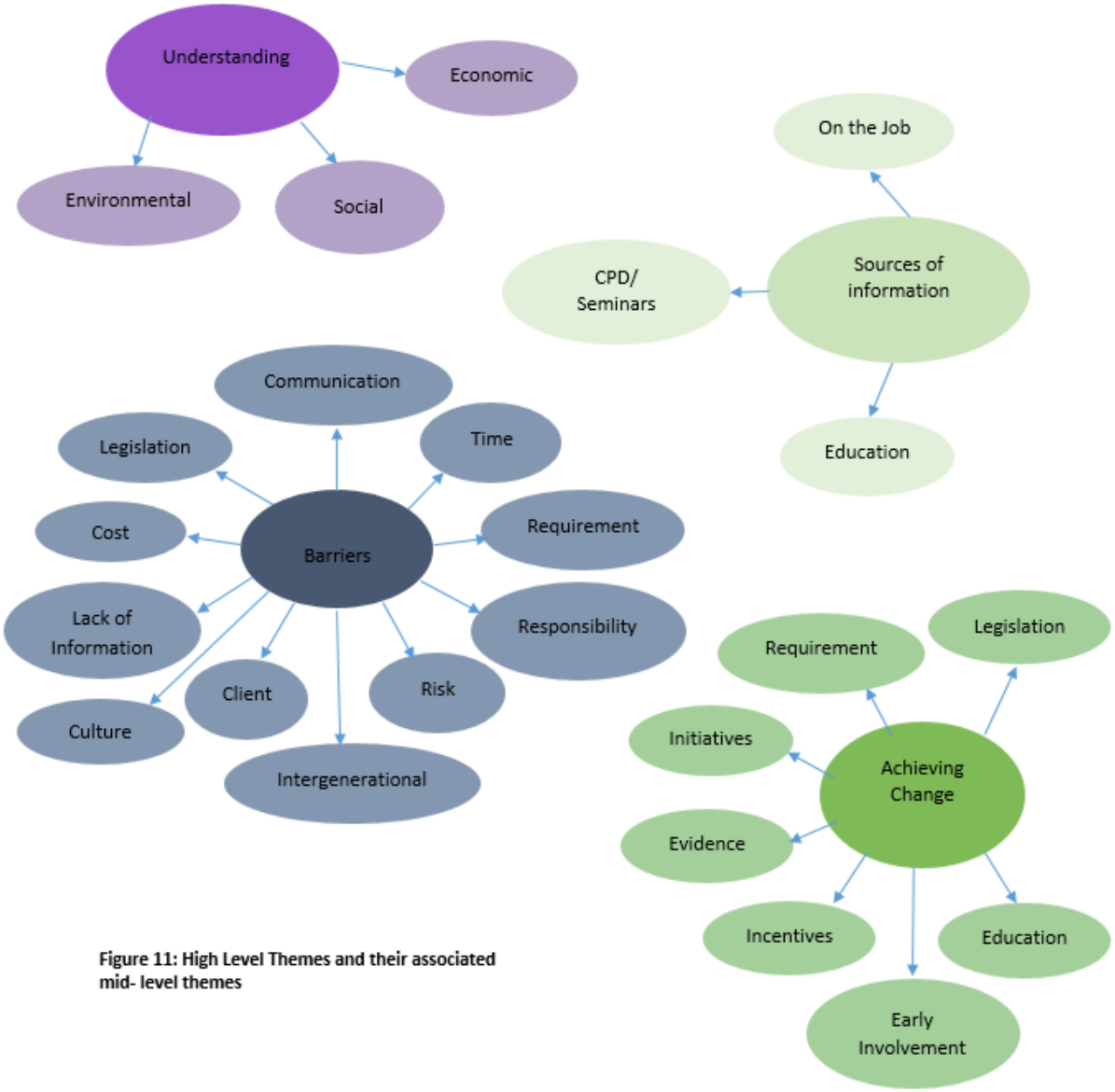


Figure 11: High Level Themes and their associated mid- level themes

6.5.3.2.1 Understanding

All of the FG discussions started by asking participants what they understood by the terms sustainability and SD. Probes were used as and when necessary as per the topic guide. Knowledge of sustainability and SD was loosely understood in terms of the 3 dimensions and was initially quite limited with statements such as "whereby development seeks to reduce the impact on the environment" with no real elaboration on the issues therein. Across all groups, initially answers were articulated in terms of energy and environmental impact in terms of minimising environmental impact, reducing waste and reducing the carbon footprint, specifically regarding the energy that is used to build and the energy that is left in a building once it is complete. However despite initial vague answers from all participants, as the discussion progressed it became clear that participants did have more of an understanding of SD and the other dimensions it encompasses. Figure 12 shows the thematic model for 'Understanding'.

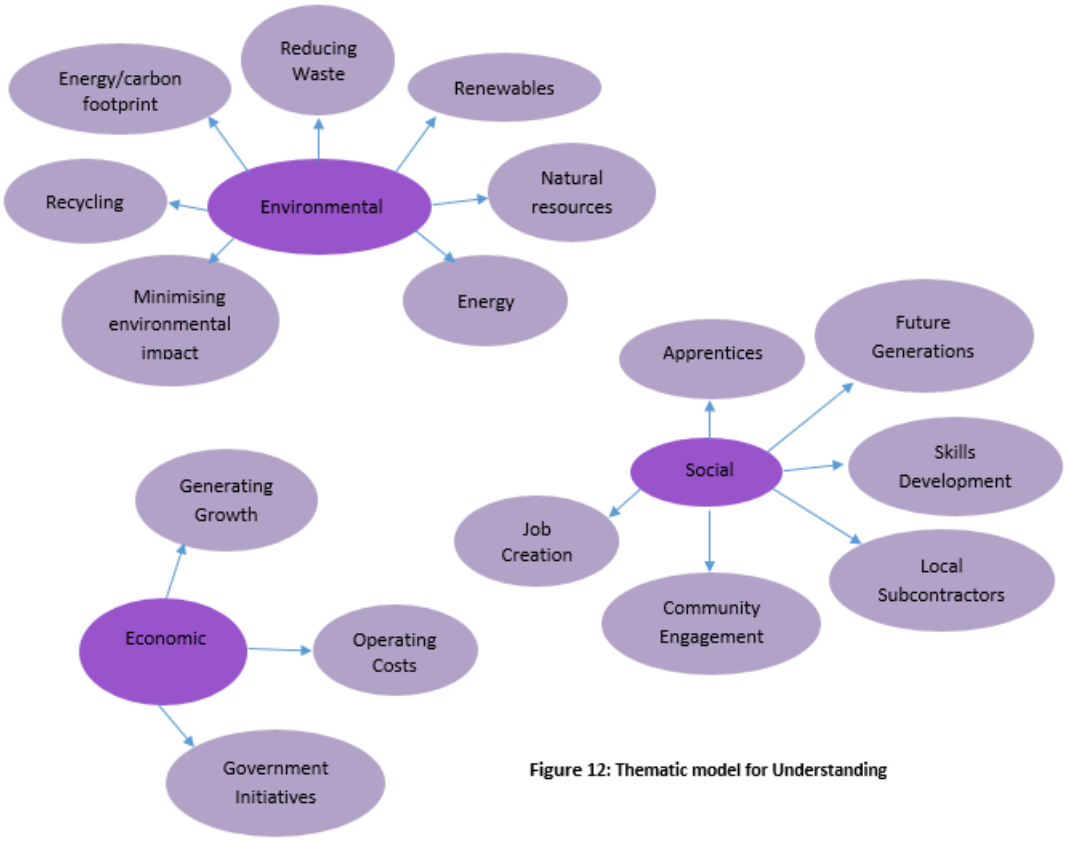


Figure 12: Thematic model for Understanding

In reference to the social aspect, whilst the literature posits that the social dimension is thought to be largely ignored, it was clear from responses across all groups that this aspect of

SD is recognised by industry through their working practices and that it is becoming increasingly important on the agenda with references made to involving the local community, obtaining apprentices and creating jobs locally and that construction practices do not adversely affect the people in the local area but rather benefit them in that construction can impact on the wider community in that "*by what we do, we can be denying or reducing the quality of the environment of the people who live around what we're building*." All of the FGs mentioned preserving for the future generations and linked this back to minimising use of resources in that we can achieve this. Whilst the student PFG articulated knowledge around the environmental aspect, when asked directly if they were aware of the 3 dimensions of SD, all student PFG participants were not clearly able to articulate their understanding around this even when prompted that this refers to the economic, environmental and the social aspects. When probed a little further however, the PFG did show some understanding of the social dimension of SD eliciting responses such as "*preserving for the future generations*" and "*social would that be providing the needs of people in the area therefore such as needs to accommodate them social as in leisure activities and those sorts of things*".

Interestingly there were no direct responses in relation to the economic dimension however awareness around the government initiatives and how this will impact economically, mostly in relation to how implementing SD will affect the end operating costs, was mentioned but that this might still not be the most sustainable option. In addition, it was understood by the majority in terms of how the construction industry can influence social outcomes and how this can generate growth within communities through the provision of apprenticeships and jobs for local people.

Overall, references to the 3 dimensions of SD were largely mentioned independent of each other however two participants did make reference to a more holistic approach when considering SD with stating that they tend to look at it from 'a three legged stool perspective' incorporating the environmental but also the economic and the social and that when building buildings they should not only reduce environmental impact but should also be designed to incorporate sociability and enhance the local community.

No definitions pertaining to SD were mentioned either by students or professionals, except in one instance where the Brundtland report was cited however this had clearly been a rehearsed response quoting the definition word for word.

6.5.3.2.2 Sources of Information

In order to gain an understanding of where and how knowledge is currently disseminated regarding SD, it was probed as to where the participants' perceptions and understanding of SD comes from. It was anticipated that this might also shed light on how this impacts on their attitudes towards SD. Whilst this theme very much links with the understanding theme as it is through these sources that their knowledge and understanding is gained, it was decided to leave this theme as a separate theme however as it provides important information as to methods of delivering knowledge of SD and whether or not these are working. There were three sources identified, namely education, on the job, and CPD. Figure 13 shows the thematic model for 'Sources of Information'.

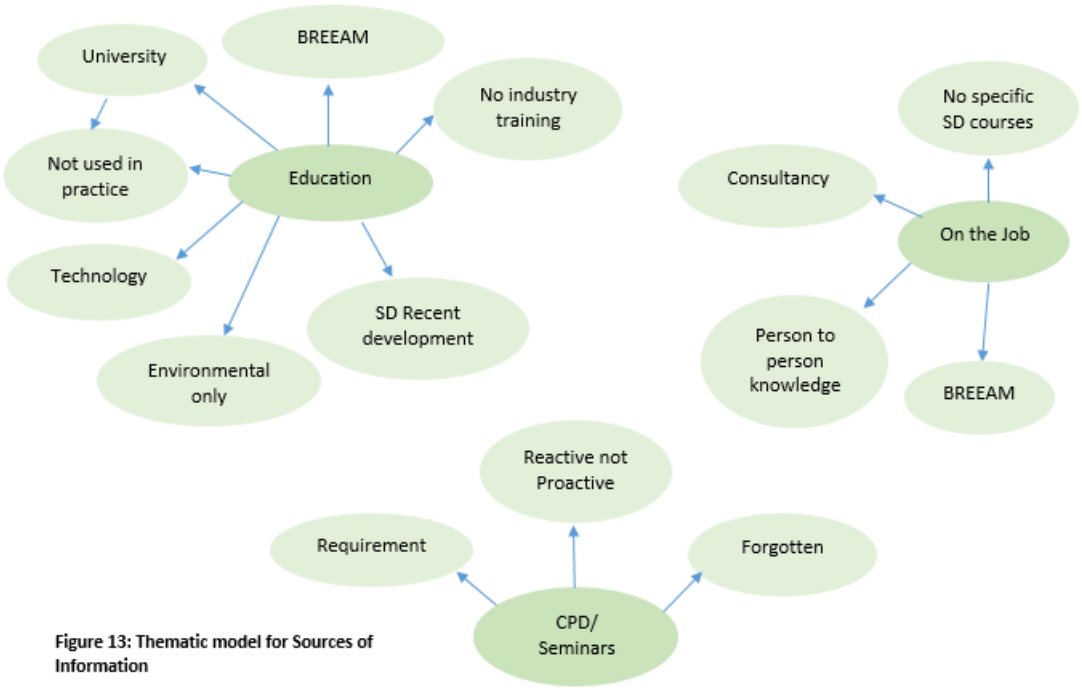


Figure 13: Thematic model for Sources of Information

Three of the professionals stated that they had learned about BREEAM at university but that once in practice they have never utilised it and that in terms of education, SD has not been on the radar that long. For the student PFG as would be expected, their knowledge mostly

came from education. Two students stated that they had not covered the 3 dimensions, and in one case it is something that is only integrated into the course in relation to the technological aspect focusing on key systems and how you input them into a building rather than looking at anything else.

For the majority of participants, it was implied in their responses that their knowledge has developed as and when aspects of SD is required on projects and that it filters through the grapevine in a manner of speaking. It was stated by one participant that despite having been in industry for over ten years, they had not seen or heard of any formal sustainability training. It was again more a case of 'people to people knowledge passed on' from those who have encountered SCPs and had some experience of implementing the same such as BREEAM. This knowledge is then taken with them from job to job and if sustainability is a requirement, they just 'try to do the best' they can with that knowledge. One of the students in the PFG stated that in addition to education she too had learned about SD 'on the job' through a project that she had been involved in on the development and design of a new power station in Anglesey. In addition her knowledge had also come through personal experience in that she had grown up around it having family members who work in the eco-efficiency side of SD such as solar panels.

One of the participants stated that they tend to instruct consultants on such matters, due to a lack of understanding and knowledge on their part, in particular regarding carbon in order to demonstrate to the client the information regarding the carbon that was in the products that they use.

The next source of information were participants stated they obtained SD knowledge from was that of CPD or similar events such as seminars which the FGs described were a means whereby they gained understanding and knowledge around SD. Participant's views of such events came across as really positive with comments such as "*I went to a seminar last week about community involvement and that was great*". However, despite the positive enthusiasm expressed, it became clear that in practice many of these events are only attended as industry are becoming more aware of certain initiatives and the fact that they are becoming essential in terms of the projects that they will be working on indicating that

attendance at such events is reactive rather than proactive and perhaps just another box ticking exercise. It was stated that essentially somebody goes along to the CPD event as it has been identified as an important issue by somebody in the company for example the head of the firm, and the attendee is expected to come back and report this to the rest of the company which is then in most cases subsequently forgotten about and is even sometimes 'already out of mind' before they leave the event.

6.5.3.5.3 Barriers

Throughout the discussion, and in particular when asked what their thoughts were about the construction industry and SD, participants' responses resonated very much with the findings in the literature review that a number of barriers prevent SD being fully realised in practice. The barriers identified extend on those identified in the literature review and were grouped as sub themes under the overarching theme 'Barriers', namely cost, the client, risk, time, requirement, intergenerational, culture, legislation, information, responsibility and communication. Figure 14 shows the thematic model for 'Barriers'.

Respondents were somewhat defensive in that most put forward comments that in many cases they do try and act sustainably with many of them having sustainable options in place, but that the majority of the time at the end of the day, the final decision is not down to them. It was expressed that it doesn't matter how green an individual or the business is, at the end of the day the businesses are run along the lines of the client's requirements and they simply respond to what the client wants. This reflected the responses in relation to attendance at CPD events above in that regardless of what impact it has on individuals who attend such events, if it is not followed through by the company then it is simply forgotten about. Interestingly the PFG also demonstrated awareness of the barriers that face industry despite having no practical experience within industry itself.

In support of the literature cost was viewed as the major barrier to implementation and that it will always be considered first in particular due to the current economic climate and downturn that the UK has experienced during the last few years with agreement on this issue between and within groups. It was stated that in terms of sustainability, this is only carried

Figure 14: Thematic model for Barriers

out "*if it saves the company money or anyone money*". It was expressed that this is mostly due to the fact that budgets are still tight after the recent economic downturn and that when the economic climate changes and people are being judged on quality and not just cost, then "*we can then try to go more for sustainable items because that then gives a better value to the project*". This comment also reflects how participants view SD in that they see it as adding value to projects and not just from a costs perspective, but that SD overall produces better quality buildings. One participant in particular stated that their company was proactive in SD however that as we hit the economic downturn people couldn't afford it and the market moved on stating that "*We were trying to sell people a Ferrari when they could only afford a Fiesta*".

As mentioned above, the student PFG also had awareness of the barriers facing industry in particular the costs barrier and were also of the view that if SD costs more people simply won't have it with one participant stating "…*it's all down to money again. People will only use it if it costs them less money, because I don't think, well nobody's really kind of against having a sustainable building or against making it because it's purely just, it's not cost-effective for them to do that, so if you can make it cost-effective they've got no reason not to do it really*".

Another major barrier which related to cost was that in general, clients see SD as too expensive to implement and whilst participants' try and use recycled products wherever possible and try to minimise any impact, ultimately they can't achieve 100% sustainability until clients want to pay for it and presently they're not. Another aspect that related to the client was ownership. This was seen as a big factor as to whether SD will be chosen in a project in that for projects where the client does not maintain ownership they are less likely to want SD as they will not see the return on their investment and essentially want immediate profits when they sell the building on but if they are the sole owner they may see the potential in it.

Essentially if the use of SD does not benefit the client then more often than not they simply do not care as it is not affecting them financially. One participant referred as an example to a conversation with a property manager who owns commercial buildings stating that "*it's not relevant to me as the use of electricity in this building compared with the total cost of running the building, the capital cost, repaying the mortgage has no consequence as to how much*

electricity the building uses because in the total costs of everything that factors say paying back the mortgage etc., maintenance, staff etc. etc. that bill is of no consequence".

Again it was evident that many of the participants had a positive attitude towards SD and stated that they do have sustainable methods in place that they can use, however as much as they try and 'sell' it to the client, the bottom line was that if the client perceives it to be too expensive they will ask that other materials and the like are chosen. Even where participants worked in areas where clients wished to engage in SD, again it came down to cost as the ultimate driving factor and that even those wish to engage such as those in the clients in the social sector have got financial constraints.

It was clear from the FGs that the business case for SD has not been fully realised within industry as yet. It was commented upon that from a business perspective SD can be seen as too risky and to take the lead in SD, which appeared to be perceived to be very much into the unknown, is not in their own interests as it could or would potentially put them out of business and is in general not a good business strategy. Participants commented that customers won't accept change and that they just want to be safe and have something that they know that works.

Time constraints were mentioned as a significant barrier to the implementation of SD and that as industry has become more advanced over the years this has actually meant there is an expectation of faster project delivery time giving them less time to design and get the project built, meaning that SD falls by the way side "*They're not really interested in all the bits about the construction and design, they just generally want it fast because they've laid out all this money and they've got to start earning off it to put buildings up like this and fill them up*."

Interestingly it was commented upon that on jobs which go through the North West Construction Hub which has a focus very much on SD and was mentioned elsewhere during the discussions as a vehicle for SD, that projects here too are subjected to the same time constraints and that the sustainable section gets pushed towards the back because it's more a case of driving the design and getting the client what they want within the prescribed time period which are in themselves very tight to begin with one participant stating "*at the minute*

on the small work side we're getting about six to eight weeks maximum to get drawings made, specifications made, price, backing, sent back to the client and then on site. The period that you need to get a fully sustainable design on that just isn't there at the minute on the hub".

It was expressed that the economic downturn has also had a knock on effect in terms of time in that a lot of companies had to let staff go during this time which meant and still very much means that there is the same work but fewer people to complete it and that again sustainability is not high on the agenda as a result. One participant commented that they are trying to do the same amount of work with a third of the staff they had 6-8 years ago and that if something comes in on sustainability, they will pick the last person in the office whose still fresh faced and not having any great input on the business and send him off to the course to take notes and come back and do a 10 minute presentation in a monthly meeting and that will be it, again forgotten about.

One of the participants in FG3 was a student on placement and the researcher took this as an opportunity to explore how the education they had received was experienced at their place of study and how this was being imparted in the world of work if at all. The findings from this were that much like industry, time and resources are a major factor within HEIs and that when students do try and integrate SD, it is not seen as a priority (within this student's institution at least) meaning it gets pushed aside demonstrating that there is still a great deal to do in HE in terms of SD also. To emphasise this point the comment from this participant is provide below:

"*You get told well quote don't talk to me about the environment you've got 10 minutes with me this week let's talk about how your building stands up or what that room looks like inside don't talk to me about fire escapes and H Vac systems we haven't got time so then I'm thinking ok well is that not priority then and then you get to the end of it and you're expected to know sustainability but then there's only so much you can Google only so much you can bring in from lectures without having someone explain to you why that actually works in reality but then there's no time*".

This was however expanded upon by another participant who commented that this is perhaps in part due to HEIs these days having more students but the same number of staff and having recently spoken with an academic acquaintance this was confirmed with him stating there are also only so many hours in a day. However this argument was countered by another participant who stated that regardless of numbers, the right information should be able to be delivered to a small or a large group of people.

The next theme that arose from the data was 'requirement'. Throughout the discussions it was mentioned on a number of occasions that in instances where SD is implemented, in many cases it is only done so as and when it is a requirement as generally if they don't it means losing work. In this respect, it could be seen that when SD is a requirement it is in essence achieving SD, however the analysis actually revealed that such practice is in fact impeding true implementation of SD turning such 'requirements' into 'box ticking exercises' and in many cases much of this is not actually SD. Such practices are also making industry reactive rather than proactive as a result meaning that only compliance levels are being met and no great innovation is being achieved.

A lot of participants mentioned the likes of BREEAM and other 'requirements' such as the social aspect in terms of creating jobs locally do help, but that they create a culture of 'box ticking' and when it starts to cost more such as achieving a higher level within BREEAM standards, again only the minimum level will be looked at as clients will not want to pay the extra to make the building BREEAM excellent and so tend to just aim for BREEAM good. It was also stated by one participant that once you hit BREEAM good, in going beyond this "*you're not benefitting the building greatly*" in any event.

Even where industry is trying to be innovative and developing SD methods, driving it down the supply chain is a challenge. In the main, as long as they have ticked the boxes many will not go above and beyond the requirements or compliance. It was commented upon that even when boxes are being ticked, no real thought its being placed on just how sustainable the practice actually is, with one participant having had a developer stating "*well in order for it to be a sustainable development all they need to do is put a bike shed on it. If I put a bike shed on it I tick the box*" and that even when using solar panels they are not utilised properly or

effectively "*You might be required to put say solar panels on a building because it's a planning issue and it might be a north facing roof, it's not going to work very well, maybe 20% efficient. But no one really cares about it because you've satisfied planning*". One of the student participants also commented on the fact that often when SD is put in place, it is not really thought out properly in terms of how the location can effect what is being implemented and it actually becomes inefficient again referring to solar panels as an example. Overall, it would appear that making aspects of SD a requirement stifles innovation.

The next theme related to that of intergenerational barriers. There was a general consensus within and amongst the groups that the construction industry is a somewhat 'mature' industry with "*many people in the industry that are in the twilight years of their career that will not change*" and that the older generation's attitudes and perceptions towards SD are a barrier towards adoption of SD. Indeed the industry is generally lead by the older generation who have become used to a certain way of working and it was stated that it is perhaps this generation who need to be persuaded but that unless they can be shown some incentive to change established working practices, this is unlikely to happen as they won't change what in their eyes already works. This intergenerational barrier was also seen as a barrier to getting clients to buy into SD in that if the company isn't on board how can they possibly convince clients. The majority believed that it will take a generation of change to see any real implementation of SD and that as the graduates who are being educated and learning about SD begin to run the industry, then change will slowly filter through.

The PFG also recognised the intergenerational attitudes and how they are a barrier and that industry is stuck in this mentality stating that for this generation, many were educated in a time when the minimum requirement for SD was insulation and cavity walls and that they don't come from an age when sustainability is the main pressing issue, but in their time, it was all about "*let's make money let's build, build, build*".

It was evident that there are certain cultural behaviours within industry that keep the status quo in situ leading to the barrier theme 'culture'. The fact that the industry has a 'preferred' supply chain was something that came up amongst all the professional FGs with all recognising that it is not the most sustainable but that this is the standard practice and that

it doesn't matter how far distance wise these suppliers are they will still use them "*a lot of architects and consultancies use or prefer certain manufacturers. They don't consider if it's from down south, up north, on the west coast, the east coast, it's I like the look of that, it looks aesthetically pleasing*".

Again in relation to standards that the industry work to, it was referred to that despite changes in these standards, there is still a 'preference' for what standards they actually use because they 'work'. One participant commented that despite the British Standards being withdrawn in 2010 and replaced with the Euro codes, most still design to British standards because 'it still works' and people are still accepting it. In addition, it was stated that 90%-95% of clients will still accept designs to British Standards and that only when they stop accepting designs to British Standards will industry start using the Euro code designs. Again it was a case of what the client wants with one participant commenting "*we ain't gona give em it if they don't want it*". Another participant from FG2 highlighted the fact that there is a British Standard for sustainable procurement but again they don't tend to use it.

It was also referred to that there are issues with our culture in society in general in that people are used to a certain way of living and changing the public's mind set is required for SD to not only be implemented, but to be used effectively. One participant using a school which had sustainable features with everything centrally controlled as example of this stated the occupants did not like 'losing that control' in relation to being able to open windows and the like themselves and that people now want to go back to just opening windows for themselves.

Again in another group the fact that we need to change the mind-sets of society was also was mentioned. Using the example of houses that are now built without radiators, it was stated that people don't like change and that whilst we don't need radiators as new houses are built with so much insulation in the walls and so airtight that you never have to turn radiators on, people are just used to having them and "*when they're cold they like to turn them up*". Much like industry it was commented that changing such perceptions will take a long time.

The issue of legislation was a topic that was discussed frequently across the groups in relation to a number of issues and is the next theme discussed. Legislation was very much seen as a

key driving force behind sustainability and is included as a subtheme in 'Achieving SD' also described in the next section, however it was stated that in some cases it can actually hinder progress towards SD and is actually a disincentive and can stifle creativity. One participant felt that the Government is actually "*positively discriminating against refurbishment*" because of the 20% VAT charge that is incurred in refurbishing a building whereas you don't pay VAT on new build and in this respect felt that "*the Government is actually making a decision to disincentivise refurbishment*" and that in some cases it has been cheaper to pull down and rebuild than to refurbish as a result of the 20% surcharge.

It was also felt by some participants that legislation 'stifles creativity' in that legislating and saying to people 'you've got to do this' only serves to make people adhere to those limits again bringing it to the level of a 'tick box' exercise.

The next theme that arose from the data analysis was 'information'. Consistent with the literature, it was conveyed that there is not a lot of information available that assists in being able to make informed decisions particularly in relation to materials and that what information is available is very fragmented and it doesn't actually specify how to do it. There was also an element of distrust in that sometimes when they are told something is sustainable this claim turns out to be not entirely true. For instance it was commented that in some cases "*manufacturers will come in and market their products as green but that there will be something in there that probably completely counter products the case they make and industry just aren't aware of it*". Thus even when making sustainable choices, they can't always guarantee that they are actually sustainable ones, but have to base their selection on the basis of the most sustainable option available to them. Obtaining information as to where materials are from when selecting materials in order to be able to put these details against costs and locality in terms of SD also appeared to an issue and that if there were some form of matrix where all this information could be pooled and accessed, this would make it a lot easier to choose more sustainable options.

It was alluded to that there is also a lack of understanding amongst the general public in relation to products which can also hinder choosing SD. Again reference to changing the public's perception was made in that people don't like change because it's not what they are

used to. One participant used the example of timber framed homes to illustrate this point "*it was the same when timer framed homes first came in the early 80s, first of all they got very bad press because people just didn't understand them even though they were massive on the continent but people didn't like timber framed homes because it's not what they're used to*". It was interesting to note that out of all of the FGs, only one participant commented that perhaps a lack of information is the reason for the perceptions that SD is too expensive as it is not always the case.

As per the literature review in Chapter 2, a wealth of literature has started to evidence that there is a lack of ownership of responsibility for SD in industry and that uncertainty of and shifting of responsibility is clearly a barrier towards the adoption of SCPs. As such during the discussion regarding participants' views of industry and SD, the researcher took the opportunity to ask participants for their views regarding responsibility. This elicited mixed views with answers very much dependent on their own position with most recognising that they all have a role to play but some perhaps have a bigger role to play than others particularly those involved right at the beginning of the project such as the designers and the project manager as they can have an impact on the design and therefore the materials chosen. It was commented that the duration of the job is also a factor again going back to the end user aspect in that a contractor who is only working on a project for 12 months will "*not be interested in what the end user saves in 25 years because it's not your remit to decide that if they've not specified tha*t".

There was a general consensus across the groups that Government should have the most influence but that it should not be totally responsible and that industry needs to step up and meet targets that have been set. One participant commented that graduates should be coming out of university and driving it forward, inferring it is the responsibility of HEI's however as previously discussed, some thought that graduates will not have any effect and that it is those running the industry that need to take responsibility but essentially Government should be leading the agenda.

The final sub-theme that emerged in relation to barriers was communication. It was expressed by some that in working practice lines of communication are poor to say the least and that industry in general is poor at collaborative working. An example of this was provided

in FG1 where on a project, information within the 'green guide' on a project never made the leap from the designers which led to them having to backtrack and trying to understand what was being used in the supply chain. This again aligned with the literature in that industry is still very much fragmented which causes communication breakdowns, loss of information and prevents SCPs being fully implemented.

From the client perspective it was seen by some that with larger organisations communicating SD is even harder to achieve as you're usually only ever dealing with the 'middle man' who has been briefed by a number of other people higher up the chain if the client is a corporate body of seven hundred people, and so you only get a very narrow view from that person. Where the communication paths are shorter, it was felt that there are more opportunities to have discussions around SD and try and lead clients in that direction.

6.5.3.2.4 Achieving Change

As per the objectives of the FGs outlined above, the discussion moved on to questioning how participants thought change can be brought about within industry and how HEIs can help in achieving this change. The subject matter 'Achieving Change' was used as the overarching theme. A broad range of answers were elicited resulting in 6 subthemes coded namely Legislation, Evidence, Initiatives, Requirement, Incentives and Education. Figure 15 illustrates the thematic model for Achieving Change.

The first theme generated here was legislation/requirement. Whilst legislation was seen as a barrier, as previously discussed there was a consensus across groups that legislation is also the greatest driver for SD with the majority stating that the construction industry generally takes its lead from legislation and that it doesn't change unless legislation changes and to drive sustainability industry will need to be forced to change. Without this, it was stated that it might take five, ten, fifteen years for industry to adopt SCPs themselves. It was also suggested that there needs to be a specific deadline that industry must change by otherwise it will be a case of "*oh well we'll try and meet…*". Suggestions for requirements outside of legislation were also made such as the client requiring SD on projects or building SD into building regulations and the like and became the next theme. Suggestions put forward included things such as putting a British Standard on a product and like the green guide,

specifying at the start what type of green products are to be used or building BREEAM into building regulations.

Figure 15: Thematic model for Achieving Change

The next theme discussed was initiatives. Many of the participants saw initiatives such as BREEAM, BIM and GSL as a driving force and that as these come into play they will perhaps help overcome some of the barriers in relation to costs. In particular, as clients start to become more informed from the beginning of the project process they will begin to see that in the long term SD will save them money. Many of the participants were of the view that the more people are involved in the early stages of the project planning the better, particularly the consultants as they drive the initial design with one participant stating that "*a lot of legwork for me has to be done before those tender documents even hit us as a construction company*" and it was seen that the likes of BIM will enable this.

It was also stated that the likes of BIM will also help industry to make more informed decisions particularly in relation to energy and materials, as the BIM model will have all the information pertaining to each component including the cost of each component, its place of purchase, how much carbon there is and how much embodied energy goes in to making it. Again however it was highlighted that industry are reactive and mostly only engage with such initiatives because they have to or they won't get on tender lists, but it is moving things along nonetheless, as for without the mandate of BIM by 2016 for instance it would have taken a lot longer for industry to start engaging with this process.

Evidence was stated as another key driver for change in terms of costs evidence and exemplar projects in that if clients can see evidence of costs savings and the benefits that adopting SD will have for them they are more likely to be on board, particularly the private sector.

In terms of exemplar projects as a means for achieving SD this was reflected in a comment made in FG3 in which it was expressed that seeing the project in real time/life is important and that on the job learning is invaluable, particularly for students as the get to actually see the process and can interact with the various people involved in the project such as the contracts manager.

In terms of incentives, this was a question prompted to the groups and interestingly it was expressed that disincentives rather than an incentives would potentially make people engage in SD in that it is better not to lose money than make it. For example, it was stated that if it's a requirement to take on apprentices and you don't then you will lose that job and so that is a huge financial disincentive. It was also commented that this could also have far wider reaching impacts such as not getting on larger frameworks such as the North West Construction Hub which is an even greater financial incentive. Whilst previously box ticking was regarded as perhaps a negative practice, it was mentioned that it is also an incentive as it adds value when bidding for future projects such as the requirement to take on apprentices.

One participant mentioned that their parent company offers incentives in the form of a bonus for employees for attending a certain amount of CPD training per year. However as already previously established, much of CPD training is a box ticking exercise and nothing is usually

actually implemented from what is learned. The fact it is used as a 'bonus' scheme further emphasises this point in that employees are not going because they are interested, but purely to obtain a bonus.

The PFG stated that SD is something that has perhaps become overdone in terms of trying to 'drill it into people' and that something interesting needs injecting into it to get people interested again. It was suggested making SD 'fun' by having competitions for exemplar projects lead either by Government or by industry itself with cash prizes might be one way to incentivise industry. This also linked with the evidence theme in that providing exemplar projects and allowing people to see great examples of innovative sustainable design will help to drive SD forward.

The final sub-theme of achieving change discussed is that of 'Education'. The last objective of the FG sought to ascertain in what ways participants thought that HE could help achieve SD so as to inform the development of the interventions for this research and the researcher prompted participants for responses to this as per the topic guide.

The majority of participants were of the view that SD will 'have' to come through education as essentially it will not be achieved in industry, however there were also a few who thought that regardless of education, at the end of the day ultimately this in itself will not be enough and that no matter how much graduates bring with them, unless those running the business are on board it will not be implemented supporting the earlier findings that leadership is vital for SD. Those who were in education or had recently been, stated that SD is integrated into the curriculum rather than as a separate module, however it is what is taught and how it is taught that is important and that learning about BIM is very useful in respect of SD.

This last comment on educating students on the likes of BIM was a subject mentioned across all the groups. It seemed that participants understood that this is the way industry is going and that it will be important for students to be equipped with such skills. It was in fact expected by some participants that graduates entering industry now will be educated on SD and BIM indicating that HEIs should be educating students in this respect as once all graduates have these skills then industry will start to change. It was recognised by some participants

that the skills that students come out of university with are way ahead of what they are currently capable of and that these skills are not something that they as a business develop internally and so it will take that generation of students to come in and utilise their knowledge and skills to drive change.

It was also discussed that perhaps students could do more in terms of educating themselves outside of the curriculum and attend the seminars that professionals go to as a means of collaboration. It was expressed however by the student on placement that whilst this was a good idea, this would need to be better supported by staff and explicitly expressed to students that it is essential for understanding the industry once in practice as again much like industry, students will not do this unless it is a requirement either.

Educating clients as to what we mean by sustainability was seen as important for achieving SD but that it is something that is going to take time as industry have worked in a certain way for so long and clients are still going to want to spend as little as possible and make as much as possible, but that once perceptions have been changed, then it will start to happen but it will be a very slow process. In a similar manner, the end user was emphasised in that it is important not just to educate, but to involve them in the projects happening around them so they understand what is going on and are more likely to be on board. It was stated that SD is a learning curve for everyone and that most people are in the same situation and so awareness across the board is needed. Essentially it was articulated that we need to educate everybody including those buying the end product as clients won't build something that the end user doesn't want.

The student group felt that they needed to become more aware of SD themselves to be able to give the knowledge to the clients stating that "*therefore we need to be taught properly and given enough knowledge to be able to confidently go out to clients and tell them this is better than, this would suit you better and things like that*".

Other ways of achieving SD were put forward by the groups that did not necessarily fit into a particular category but that warrant attention. In particular it was interesting to note the PFG student responses in relation to this question as they seemed to centre around more

sustainable solutions, i.e. what should be happening in industry such as refurbishment, using prefabricated buildings, making buildings last longer and taking example from other leading countries such as Iceland who use geothermal energy to heat houses and take pointers from them, indicating that they are very much on board with SD. However as evidenced throughout this discussion, what happens once in industry reflects a very different picture making the use of such solutions hard to implement.

6.6 Discussion

The results of phase 2 revealed that the status quo still very much remains in the construction industry corroborating the earlier literature review findings with regard to the many barriers that exist towards SCPs whilst also supporting the need for this research. In particular, all participants stated that cost is the greatest barrier to adoption and that unless SD is legislated or that clients start to demand it more it simply won't happen. Contrary to the literature however, the analysis indicated that attitudes towards SD were quite positive on the whole amongst participants but that due to the above barriers their efforts are thwarted. Some of the participants stated that they do try and incorporate SCPs but ultimately the client has the final say.

Another outcome from this investigation was that due to the 'maturity' of the industry, it is going to take a generation of change as the older generations attitudes towards SD are far more entrenched than that of the younger generation. Based on this, at an industry level, SD needs to be driven from the top down as unless those that are currently running the industry, i.e. the decision makers, are on board with SD again it simply won't happen.

This finding provides strong support for the author's contention in Chapter 3 that we need leaders who are engaged with the SD agenda and that such leaders tend to be individuals who have higher levels of EI supporting the inclusion of EI within the research. In this respect, leadership training which incorporates EI must be made a core focus for any kind of ESD for both HE and industry. Leadership is important for shaping any kind of organisational culture and as established back in Chapter 3 is vital for SD. In particular, Project Management courses and Construction Management courses can play a vital role in this respect and thus emphasis should be placed on these and other areas where leadership roles take place.

In respect of the costs barrier, HEIs as places of research have vast opportunity to identify new and innovative ways of developing cost effective solutions for SD and also to train students in articulating the benefits of SD to clients. However it was identified from one of the participants who was currently on placement from university, that SD is not a high priority due to lack of time in the curriculum. HEIs are however the very place where SD can be inculcated so as to become 'the norm'. As Aziz *et al.* (2012) state, "*university as a higher education provider is the place to reform and develop students' knowledge, skills and attitudes towards sustainability because as problem solvers and innovators, they play a crucial role in the development of a nation*" (p513). If we are to build sustainability, we need for it to become standard practice in taught education, not simply an add-on. The results from the FGs provide further insight into the culture and behaviour of the construction sector and that much work lies ahead in respect, not only in respect of changing the minds of the industry, but that of clients also. Without educating those who can influence clients, it simply won't happen.

When asked as to how they thought that SD could be achieved so as to inform the development of the intervention, it was reiterated that SD would predominantly need to be driven through new recruits to the industry i.e. through graduates as the behaviours and attitudes of those currently in industry are too entrenched and again unless forced to by legislation or regulation, the majority will and do not participant in SCPs. Unfortunately in this respect, the data from the FGs did not provide sufficient information to assist in the development of the interventions for the next phase, thus a review of the literature was undertaken as to what would be the best methods of deployment for an intervention and is discussed in the next chapter.

6.7 Summary

- The findings from this phase were very much in line with those of Chapter 2 in that a number of barriers preclude the implementation of SCPs, with cost and clients the greatest barriers to adoption.

- Leadership for SD will be vital if we are to see any organisational change driven within industry.

- One aspect of achieving SD is that it will need to be driven through education through new graduates to the industry who are equipped with the skills and knowledge to enable them to make more sustainable choices in their chosen professions.

- Leadership for SD needs to be incorporated into BUE courses that entail leadership or management roles such as project and construction management.

- Costing of sustainable options should be addressed at the HE level so that students can make more informed choices and to enable them to inform clients as to the options that are available.

7. Developing an Intervention for Attitude Change

Based on the findings in phase 2 that one aspect for achieving change in industry is through new graduates, this chapter sought to review and evaluate the literature pertaining to methods of learning so as to inform the development of an intervention to be used with built environment students that would encourage attitude change.

Higher education institutions typically concentrate on delivering discipline-specific knowledge and skills (Murray *et al*., 2013, Shephard, Kuskova and Patzelt, 2009) with the goal of mastering the subject matter at hand (Moore, 2005). However, for attitude change, as is the purpose of this research, many authors argue whether knowledge alone is enough to produce attitude change which is what is needed to move SD forward within the construction industry (Sterling, 2011), thus a different way of engaging students is needed. In 2005, the Higher Education Funding Council (HEFC) launched a consultation on SD in HE which set out a broad vision together for ESD together with an action plan. On commenting on developing SD curricula and pedagogy the report stated that "*the greatest contribution higher education has to make to sustainable development is by enabling students to develop new values, skills and knowledge. The main (though not the only) way to make this happen is through developments in curricula and pedagogy"* (HEFC, 2005: p13). A number of alternative teaching methods have developed over recent years as the teacher–focused transfer of knowledge formats, such as lecturing, have begun to be increasingly criticised (O'Neill and McMahon, 2005). A growing body of literature advocates specific pedagogies and teaching methods for ESD yet adoption of such methods is low (Armstrong 2011, Christie *et al*., 2013). In order to establish which methods would be most suitable for the current research, a review of the relevant literature was undertaken.

7.1 Review of Alternative Teaching Methods

There has been a widespread growth of student–centred learning (SCL) as an alternative approach to traditional methods. Here SCL encompasses any method in which students are actively and not passively involved in the learning process. A key aspect of SCL is an emphasis on deep learning and understanding. Leal Filho (2000) argues that attitudes towards sustainability need to change so that people can adopt a deeper learning approach when

being taught about sustainability. Deep learning involves looking for meaning in text and education, making connections between areas of study and relating new and previously taught information together linking learning to real life scenarios (Warburton, 2003). In the HEI environment if teachers are involved and oriented towards students and changing their conceptions (e.g. towards SD), students will be inclined to use a deep approach (Baeten *et al.,* 2010). In engaging students in activities that seek to change attitudes, a deep learning approach could be encouraged which in turn may help to facilitate attitude change. Developing activities in which students make connections between new and previously taught information relating to SD and linking this to real life scenarios would be thus be a useful endeavour in the pursuit of attitude change. Forum for the future (2004) in their 'Learning and Skills for Sustainable Development' guide also advocate the user of learner-centred approaches when developing course material for ESD.

Enquiry-based Learning (EBL) is an umbrella term used to describe approaches to learning that are driven by a process of enquiry and is situated within the broader tradition of SCL (Dewey, 1938 cited in Khan and O'Rourke, 2005). In EBL students are expected to construct their own knowledge and understandings by engaging in supported processes of enquiry, often carried out in small groups again shifting away from passive methods involving mere transfer of knowledge (Khan and O'Rourke, 2005).

Khan and O'Rourke (p2) summarise the main characteristics of EBL as follows:

- Engagement with a complex problem or scenario, that is sufficiently open-ended to allow a variety of responses or solutions;
- Students direct the lines of enquiry and the methods employed;
- The enquiry requires students to draw on existing knowledge and identify their required learning needs;
- Tasks stimulate curiosity in the students, encouraging them to actively explore and seek out new evidence;
- Responsibility falls to the student for analysing and presenting that evidence in appropriate ways and in support of their own response to the problem;

A major advantage of ELB is that it involves a deep approach to learning as students make their own connections between ideas. Brandes and Ginnis (1986, cited in O'Neil and McMahon, 2005) state that the learner experiences confluence in their education meaning that the affective and cognitive domains flow together which as previously discussed in Chapter 3, is important for attitude change. Given ELB is usually undertaken in groups, it would be ideally suited to construction disciplines as in the real world they are required to collaborate and solve problems together and so the use of groups in ELB would help to foster this. Collaboration is a key focus in industry at the moment under the Government's drive for BIM emphasised in the construction strategy 2011 (Cabinet Office, 2011) and Construction 2025 strategy (BIS, 2013). Entwistle and Tomlinson (2007) view that universities do not offer enough chances for students to experience collaborative team based learning approaches. Developing an intervention that involves group activity would not only facilitate this process it would also allow for discussion (discussed in further detail below) which is an integral part of attitude change theory. Murray (2011) promotes such an approach through workshops on SD that aim to encourage people to identify and reflect on their core values and relate these to SD. Adopting a similar approach could help to foster positive position towards SD amongst students.

In recent years, situational or authentic learning has become a popular method of teaching. Situational learning sits within cognition theory and the constructivist paradigm which posit that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. Lombardi (2007: p2) defines authentic learning as learning that "*typically focuses on real-world, complex problems and their solutions, using role-playing exercises, problem-based activities, case studies, and participation in virtual communities of practice*". Thus learning experiences should be authentic and situated in real-world learning environments that allow the learner to construct their own knowledge (Reisser, 2001). Brown *et al*. (1989, cited in Harley, 1996) proposed situating authentic instruction for students through a cognitive apprenticeship model. Cognitive apprenticeships are real world activities in which learners participate with those who are more knowledgeable than them. The teacher acts as facilitator rather than dictator allowing the student to be brought into the teacher's more mature understanding of the problem making the student an active rather than passive participant (Harley, 1996). Goh,

Cochrane and Brodie (2012) found that authentic learning environments supported by project-based learning and information literacy strategies opened up opportunities to help engineering students learn about the value of research skills and the importance of professional sources. Ideally engaging students in participatory activities outside of the classroom where students would 'do' rather than 'talk about' would create a more authentic situation, however due to the planning that would be needed for such an activity in co-ordinating all the different modules, focusing on activities in the classroom which identify SD as a real world problem would be a more realistic endeavour for this research.

Personal reflection has been advocated as an important part of the learning process. Quinton and Smallbone (2010) believe that engaging students in reflection is a vital part of learning for university students and encouraging and practising reflection should be part of routine teaching, preferably embedded in course design. Reflection provides the link between an experience and learning from that experience (Blackwell *et al.*, 2001). Reflective activities could therefore encourage deep learning and critical reflection. Quinton and Smallbone (2010: p127) contend that "*the transition from student to graduate worker requires a significant shift in thinking, including acquiring the ability to self-reflect and to evaluate one's efforts"*. Students will therefore need to be able to demonstrate transferable skills such as the ability to self-reflect on their professional practice upon entering the world of work (Smith and Pilling, 2007) particularly as it is also fast becoming a prevalent feature in professional practice (Betts, 2004). Including a reflective exercise within the intervention so that students reflect on what they have learned and experienced and how this has affected them would be a useful activity and would also encourage a deep learning process.

7.2 Review of Instructional Methods for Attitude Change

Literature on instructional design methods, in particular literature on instructional technology provides useful guidance on how the learning environment may be shaped to encourage attitude change. Three main approaches for designing instruction for attitude change have developed from this literature: providing a persuasive message; modelling and reinforcing appropriate behaviour; and inducing dissonance between the cognitive, affective, and behavioural components of the attitude (Bednar and Levie, 1993: p286). According to Zimbardo and Leippe (1991: p194) the most effective persuasive messages are those "*that*

get the audience to think about an issue or object in concrete, vivid images that have definite implications for behaviour". Findings within this literature also suggest that mediated instruction (television, imagery, photographs etc.) strengthen desired attitudinal outcomes in learners. Simonson and Maushak, (2001) state that the three most important qualities of such instruction are: the use of follow-up activities and open ended questions; the use of realistic types of media devoid of contradictory cues; and the creation of an aroused state in the learner through emotional and intellectual involvement.

Using media to present real world problems has been endorsed as suitable for creating authentic learning environments (Simonson and Maushak, 1996). Follow up discussions have been shown to be a particularly powerful tool for attitude change. Allison (1966) Faye (1974) (cited in Simonson and Maushank 1996), Bage (1997) and Wade and Poole (1983) have all found that involving learners in an analysis or critique of instruction and message presented lead to attitude change. Moore (2005) supports this view and asserts that ESD should be a process of creating a space for inquiry, dialogue, reflection, and action about the concept and goals of sustainability. Pappas (2012) contends that every endeavour should be made to facilitate understanding of the contribution of each discipline towards sustainability. Getting students to reflect on how in their professional roles they contribute to the positive and negative aspects of SD through the use of mediated instruction may therefore help students to change their perceptions and thus their attitudes whilst again facilitating deep learning and collaboration processes.

Simonson and Maushank (2001) developed a series of guidelines for use when designing mediated messages for attitude change. Their model of 'cumulative effect' (Figure 16) is based on the principle that a persuasive message must be designed effectively and provides a useful guide for the development of the intervention for phase 3 of this research.

Figure 16: Model of cumulative effect (adapted from Simonson and Maushank, 2001)

7.3 Review of Issues Relevant for ESD

As set out in chapter 2, ESD is more than a knowledge base related to environment, economy, and society. It should address learning skills, perspectives, and values that guide and motivate people to seek sustainable livelihoods, participate in a democratic society, and live in a sustainable manner and involve studying local and, when appropriate, global issues (UNESCO, 2006). For construction professionals this should also translate into their working practices and thus needs to be instilled during their formative years in education. This needs careful consideration when embedding ESD in HE as previously stated, knowledge is not sufficient and Shephard (2008: p89) sums this up perfectly stating "*It is quite possible for learners to learn about their subject and be able to describe, comprehend, apply, analyse, synthesise and evaluate to the extent that they can pass their exams, without actually changing their attitudes as indicated by the way they respond or behave afterwards*". Thus for sustainability

to be truly realised in construction, we need graduates who go into industry with the right mind-set already in place and that this is put into practice.

Chalkley (2006) expresses the view that ESD must seek outcomes that involve not only knowledge and skills but also the values that underpin sustainable behaviour. Chalkey's categories of knowledge, skills and values indicate that ESD seeks three primary outcomes:

- Graduates should know about sustainability issues;
- They should have the skills to act sustainably if they wish to and;
- They should have the personal and emotional attributes that require them to behave sustainably.

Knowing how to perform sustainably, and having the skills to do so, are not on their own sufficient to ensure that individual and group behaviours are in fact sustainable (Shephard, 2008). Indeed whilst one can teach students how to say integrate SD into design, as to whether they truly believe there is a need for such practices is another matter. It is the author's view that SD should be not about the 'how' but the 'why'. Engaging BUE students to think about and understand why we must build sustainability is vital for change.

Previous environmental interventions have tended to focus on raising awareness and increasing knowledge and have met with mixed results (see Zelezny 1999, for review). A new and emerging branch of literature posits that for attitude change, emotions and beliefs need to be targeted (Iozzi, 1989; Pooley and O'Connor, 2000) meaning a fundamental shift in our values and belief systems is needed as these are what guide and motivate us to act sustainably influencing our decision making processes (Kollmuss and Agyeman, 2002; Murray 2011; Redek *et al*., 2012, Cirnu and Kuralt, 2013).

In tandem with this view and those of Chalky above, Crompton (2010: p5) argues for the need to focus more on strengthening values that align with sustainability if we are to meet the global challenges we are facing. He argues that the values that need strengthening are those that are most commonly held amongst all cultures including "*empathy towards those who are facing the effects of humanitarian and environmental crises, concern for future generations*

and recognition that human prosperity resides in relationships – both with one another and with the natural world".

UNESCO (2006) states that the purpose of ESD is to integrate the values, behaviour and lifestyles required for a sustainable future into all aspects of education and learning. Forum for the Future (2004) also recommends making values and ethics explicit within course design. Focusing on re-orientating education and more specifically on 'values' which are an integral part of ESD as set out in A21 therefore seems an avenue worth pursuing. It is our intrinsic values however that need to be focused on for SD which include the value placed on a sense of community, affiliation to friends and family, and self-development. Our extrinsic values, which are values that are contingent upon the perceptions of others as they relate to envy of higher social levels such as admiration of material wealth, power, acquisition of material goods, financial success, physical attractiveness, image and social recognition (Crompton, 2010) whilst important in some respects, are not conducive to SD efforts and thus a focus away from this is needed.

Evidence in support of values for SD comes from studies such as that of Saunders and Monroe (2000) and Good (2007) who both found that caring more about materialistic goods (extrinsic values) is associated with less positive attitudes towards the environment and engaging in less environmentally friendly behaviours such as recycling and energy use (Gatersleben *et al.,* 2008). Schultz *et al.,* (2005) also found that values placed on power and achievement (extrinsic values) were associated with less concern about how environmental damage affects others, future generations and non-human life. Where people placed values on more universalistic values (i.e. intrinsic values), positive associations were found with pro environmental attitudes and behaviours. Aligning our values with those that meet the needs of SD, i.e. intrinsic values, is thus important for moving the SD agenda along and an area worthy of investigation.

The notion of values as integral for SD is advocated elsewhere in the literature (Kaplan, 2000, Parkin *et al.,* 2004; Hansmann, 2010; Armstrong, 2011) and is the most commonly reported word in many UNDESD documents (Huckle, 2012). Psychologists widely accept that values, together with attitudes and belief systems, are linked to behaviour (Murray and Murray, 2007)

influencing our individual and collective decisions and thus changes in values are a route to more sustainable behaviours (Dietz, 2005). Most of us are however unaware of our values and attitudes and need to elicit them in order to become conscious of them if we are to use them to consciously influence decision making (Crompton 2010, Murray, 2007). Crompton (2008, cited in Murray, 2011) after reviewing the psychological evidence concluded that if significant changes are to occur they would have to come from individuals' deepest values and attitudes. Creating activities that aim to broaden understanding of SD issues and which engage students in thinking about their values and behaviours and help them recognise the importance of the decisions they make in both their personal and professional lives how they can take action in these arenas, would help to develop such skills.

Pooley and O'Connor (2000) believe that if direct experience produces affective based attitudes, then the source of information on which the attitude is based, is important to further develop this attitude. Thus questioning our beliefs surrounding the knowledge we have would be a fruitful endeavour. Reis and Roth (2010) argue that emotions are important aspects for the pedagogy of 'environmental' education and are a significant component of learning and instruction in general.

Iozzi, (1989) suggested that the key entry point for environmental education in addressing the values and attitudes in developing environmentally conscious behaviour, is via the affective domain. Such notions have also been extended to ESD. Shephard (2008) in tandem with the above comments suggests that a central element of ESD is a quest for affective learning outcomes of values, attitudes and behaviours. Affective learning relates to values, attitudes and behaviours and involves the learner emotionally. It includes an ability to listen, to respond in interactions with others and to demonstrate attitudes or values appropriate to particular situations.

Work by Paul Murray (2011), an eminent academic and researcher in the field of SD, very much focuses on all the above aspects. His extensive work on SD led to the development of a workshop comprising of a series of activities. His book, The Sustainable Self: A Personal Approach to Education, sets out these in written form. The book places values, attitudes and beliefs centre stage in how we as individuals respond to SD. It looks at how we should

approach SD not as a 'professional issue' which it is very much construed as within the construction industry, but rather as a 'personal issue'. The workshops have been developed for use with a wide range of audiences including educators, students, professionals and the general public and are thus appropriate for the current research.

Thorsen (2004) suggests that teaching students to become responsible citizens through individual awareness and action is the first step in transmitting community and global sustainability. She suggests that five basic skills are needed for fostering individual responsibility: communication skills, decision making skills, problem solving skills, creativity and change management. In addition, Pappas (2012) states that "*individual sustainability includes possessing a well-developed and demonstrated value system that acknowledges the interconnectedness of all global biological systems and our appropriate place in the Natural World*".

In terms of sustainability content, Pappas also stated that it is not necessary for every discipline to cover all aspects of SD and suggests that HE curricula should integrate sustainability throughout so that students gain a wide-ranging and useful understanding of SD whilst also incorporating discipline specific tools to learn to live sustainably. With this in mind it would be appropriate to develop an intervention that is of relevance to the discipline in question but which could be tailored to all disciplines. Miller (2005: p101) states that "*effective attitude construction presents a persuasive message containing new information which relates to something the learner already knows*".

Applying various elements of the teaching and learning methods described above, integrated with factors such as values which have been advocated as relevant for sustainability provides a strong case for a successful intervention. The development, implementation and the outcomes of the intervention are described in the next chapter.

7.4 Summary

- This review highlighted that a number of pedagogical approaches exist which have been advocated for use in ESD, namely SCL, deep learning, authentic learning, EBL and reflection.

- Various instructional methods such as the use of meditated messages which target the learners' cognitions and emotions have proven to be effective persuasion methods.

- Adopting a personal approach to SD targeting our values, beliefs and emotions in conjunction with the above pedagogies provides a strong case for a successful intervention.

8. Assessing Attitude Change through an Educational Intervention

The next phase of this research investigated the efficacy of the educational intervention. Based on the review of the relevant literature discussed in the preceding chapter, it was decided for the intervention to adopt a learner centred approach and develop activities that would cover some of the recommendations within the literature such as a focus on emotions and values and the use of media and encouraging a deep learning approach via reflective exercises.

Studies on interventions tend to only report whether the same have been successful and not the reasons why (Abrahamse *et al.,* 2005). In order to ascertain which aspects of the intervention may have been influential, every effort has been made to examine the results in as much detail as possible. The methodology and the results of the intervention are provided below. A summary of each stage of the intervention is provided along with a final summary of the main outcomes and findings.

8.1 Methodology

8.1.1 Materials

Taking into consideration the recommendations highlighted within the literature and the work by Murray, a workshop booklet (Appendix 13) was developed comprising of six activities for use with students at LJMU. Permissions were obtained from the author for the activities that have been modelled on the work of Murray, (Appendix 12). Simon and Mauskak (2001) posit that generally some knowledge of the topic is a prerequisite for a positive attitude towards the idea being presented, however Murray (2011) states that prior SD knowledge is not a prerequisite for the undertaking of the activities. Students on BUE courses at JMU should already be aware of SD as many of the modules have some sort of sustainability element attached.

Taking this into account it was deemed that information should aim to develop a broader understanding of SD and the wider connectivity of the issues (Murray, 2011) rather than deliver discipline specific knowledge. As previously stated, true SD cannot be achieved unless a holistic approach is taken incorporating all three tenets (Giddings *et al*., 2002, Hopwood *et*

al., 2009). Many authors advocate the need for adopting an approach at the HE level which considers the interconnectedness of sustainability issues and how they impact on one another (Pappas, 2012). As per the findings in the literature review, the social aspect is often ignored in both HE and professional contexts, and thus ensuring a focus on all three tenets will be important if attitude change towards SD as a whole is to be achieved.

Rode and Michelsen (2008) published a set of indicators for ESD, citing the need to assess changes in attitude and motivation, understanding of the principles of SD, skills and competencies, and overall performance enhancement. The authors suggest using standardised methods to gauge attitude and motivation, while using student feedback and mutual observation of classroom practice to assess the other indicators. The creation and validity of the SDAM was described back in Chapter 4 and this measure was used to assess attitude change in this phase of the research.

8.1.2 Sampling and Participants

A random purposeful sampling technique was applied in which lecturers from the School of the Built Environment at LJMU were contacted via email prior to preparing their timetables for the new academic year (Appendix 14) in order that a timeslot for the intervention could be worked into the timetable for the new semester. The School of the Built Environment at LJMU provides undergraduate courses in seven areas which are: Architectural Technology, Building Services Engineering, Building Surveying, Civil Engineering, Construction Management, Quantity Surveying and Real Estate Management. The school also runs several post-graduate courses: Water, Energy and Environment, Quantity Surveying and Commercial Management, Construction Property Management, Commercial Property Management, Commercial Property Development, Commercial Building Surveying, Applied Facilities Management and Smart Technologies for infrastructure and Buildings as well as a doctoral research department. Six module leaders responded to the email and subsequently the workshop was built into the timetables for the modules of Construction Management (level 4), Real Estate and Property Management (level 3), Water, Energy and Environment (level 7), Architectural Technology (levels 5 and 6) and Quantity Surveying and Construction Management (level 7).

8.1.3 Procedure

The interventions took place near the end of the first semester in November 2013. The students were informed prior to the workshop that the researcher would be conducting a 2 hour workshop with them. In order to measure whether attitudes had changed post intervention, students were asked to complete the SDAM pre and post intervention.

8.1.4 Workshop Activities

The workshop booklets consisted of six tasks for students to work through. Three of the tasks were group work and the remaining three were tasks for students to undertake alone. A SCL approach was used for the workshop to engage students and get them to think more deeply about SD and their role in relation to SD both personally and professionally. Table 20 provides a brief synopsis of each task and its purpose. A more detailed description of the tasks and what they entailed is provided thereafter.

Task	**Purpose**
Task 1 – Personalising Sustainability Definitions	To think about what sustainability means to us as individuals.
Task 2 – Photographs	To personalise sustainability and create a sense of connection with the underlying issues.
Task 3 – Circles of Empowerment	To engage students and think about how they can make a difference and question our self-limiting beliefs.
Task 4 – Values	To think about our own personal values and what is most important to us and why.
Task 5 - Sustainable development and the built environment	To consider what has been learned and experienced during the workshop and use this to think about why the built environment is important for sustainable development and how as professionals we can incorporate sustainable development into everyday practice.
Task 6 – Reflection	To reflect on the experience of the workshop in how it made students feel and think in relation to SD. Did it change what and how they thought about SD.

Table 20. Overview of intervention tasks

8.1.4.1 Task 1 – Personalising Sustainability Definitions

There are hundreds of definitions relating to SD as referred to back in Chapter 1 and 2. This task was designed to be a priming task with the aim of getting students to take 10-15 minutes to think about what sustainability means to them. Simply priming a concept has been shown to lead people to identify with that concept and thus process concept relevant messages more (Petty and Wegener, 2009). A list of six popular definitions of SD were provided from which they could choose or they could provide their own definition if none of those provided fitted with their understanding of the term.

8.1.4.2 Task 2 – Photographs

As discussed in the previous chapter, those involved in instructional technology research, a field in which mediated instruction has become particularly popular, comment that a major outcome of such methods is the likelihood of the development of positive attitudinal positions in students (Simonson, 1985). Simply being told to connect with the world's greatest problems will not work, we have to experience some sort of emotional engagement with them. Photographs have been powerful in raising awareness of sustainability and communicating political messages (Scott, 2014). Research indicates that in particular imagery may be a powerful tool in eliciting changes in attitudes (see Maio and Haddock, 2010 for review). Thus introducing imagery intended to evoke emotions towards sustainability issues into educational interventions may assist in facilitating attitude change.

Students were presented with ten photographs for this task. Each of the photographs depicted the different issues and challenges concerned with SD. Students were asked to think about each picture and rank them in terms of their importance for SD with 10 being least important and 1 being the most important. In order to help them rank the pictures, students were instructed to think about the interconnectedness of the issues presented in the pictures and other criteria such as the urgency of the issue presented in the picture or how much easier one issue would be to resolve than another.

As well as discussions occurring throughout the intervention amongst the students in carrying out the tasks, once this particular task was conducted a brief discussion took place in which students were asked to briefly provide some of their thoughts as to the pictures. New

information was then provided by the researcher as to what the pictures actually depicted in order to provoke critical thinking amongst the students and question their perceptions and beliefs before moving on to the next tasks. Zimbardo and Leippe (1991) state that presenting plausible and important messages with new information to provoke cognitions should increase attitude change.

8.1.4.3 Task 3 – Circles of Empowerment

Murray (2011) posits that self-limiting beliefs cause us to be reactive rather than proactive people, meaning we only respond to situations when we are forced to. This was indeed evidenced to often be the case with SD in the construction industry in the outcomes of the FG in phase 2 of this research.

The aim of this next task was to get students to think about how they can make a difference. If we believe that we can make a difference this may alter our self-limiting beliefs and encourage us to become proactive individuals. Two circles were presented, one relating to poverty and the other to pollution. In the first circle pertaining to poverty, students were asked to imagine their concern about the issue is large but that their influence is small. They were asked to discuss as a group the things they 'can't' do and place them in this circle. In the second circle pertaining to pollution, students were asked to imagine that their concern is less but that they believe their influence is large. Again they were asked to discuss as a group the things they 'can' do and place them in this circle.

It was envisaged that this task would help students to foster communication skills, decision making skills, problem solving skills, creativity and instil a sense of responsibility (Thorsen, 2004).

8.1.4.4 Task 4 – Values

As was highlighted in Chapter 7, values are integral to SD and an important aspect of ESD. Values are concepts or beliefs about desirable end states or behaviours, which guide selection or evaluation of our behaviour (Schwartz and Bilsky, 1987). Values, as defined by Rokeach (1979, cited in Axelrod, 1994) are standards or criteria which guide action as well as other psychological phenomena such as attitudes, judgements, and attributions and are considered

deeper and more stable than attitudes, representing standards of 'oughts' and 'shoulds', and are viewed as determinants of attitudes. Our values influence our attitude towards objects or situations. Dietz *et al*., (2005) provide a good example of this in that we may value wilderness and thus our attitude towards oil development in areas of wildlife would therefore be negative.

Pappas (2012) states that the resolution of most sustainability problems is dependent upon an individual's values and his/her ability to live according to these values. Many authors endorse the need to embed sustainability values in the curriculum (Fien, 2002; Boyle, 2004; Lourdel, Martin and Bererd, 2006; Murray and Murray, 2007, Parkin *et al*., 2004). Values have long been connected with behaviour, particularly environmental behaviours, however most of the time we do not act in accordance with our values. Murray (2011) states this is due to the fact that we very rarely think about them, but that once we become aware of our values we become more aware of whether our actions reflect them. As previously stated, values also shape our attitudes and thus engaging students to think about their values and consequently targeting thoughts on an emotional level, this may help influence a change in attitudes. More importantly, including such a task in the context of an ELB based exercise may further strengthen attitude change. Discussion and debate of important topics such as SD can lead to reflection upon what we value and thus reshape the weight we place on values leading to value change (Deitz *et al*., 2005) which may in turn impact on attitudes.

This task involved students exploring and thinking about what values they care about and why. Students were presented with another circle in which they were asked to write down what they care about most starting from the centre and working their way outwards. To assist in what values they might want to consider a table of values was provided.

8.1.4.5 Task 5 – Sustainable Development and the Built Environment

This task asked students to write about how they think the BUE is important for SD and how in their professional roles they could and would incorporate SD. It was hoped that the preceding tasks would set the scene for this line of thinking engaging students to think about and understand why we must build sustainably, and to have engaged on some emotional level. As previously stated, whilst one can teach students for example on how to integrate SD into

design, as to whether they truly believe there is a need for such practices is another matter. It is not about the 'how' but the 'why'. As Sterling (2011: p19) states "*It is thinking about the sorts and qualities of learning we are involved in and for what purposes*".

8.1.4.6 Task 6 – Reflection

The final task asked students to reflect on the activities undertaken in the workshop and provide their thoughts on the same. Reflection has been identified as beneficial in facilitating deep learning and is viewed by many as an important part of the learning process. It was envisaged that this task would help students to develop transferable skills such as the ability to self-reflect on their professional practice upon entering the world of work (Smith and Pilling, 2007) but more importantly to encourage deep and critical thinking about the issues covered in the intervention to further facilitate the attitude change process.

A list of things they could consider in their responses was provided:

- How did the workshop make you feel?
- Did it have an impact on your thoughts as to sustainable development?
- Are your values and beliefs congruent with your actions?
- Have your views/perceptions of sustainable development changed?
- Overall what was your experience of the workshop? Has it made you think differently about sustainable development?

8.2 Analysis and Results of Phase 3

Attitudes need to be measured in order to know if they have been influenced. Student attitudes toward a situation can tell us a great deal about the impact of the situation (intervention) on the learning process. And so by quantitatively and qualitatively assessing the opinions of students towards the learning activities they are participating in, it is possible to improve the quality of procedures (Simonson and Maushank, 1996).

Qualitative analysis was also carried out on the workshop booklets in order that any observed effects of the intervention (quantitative) could potentially be explained through students' thoughts, views and feelings towards the issues presented throughout the intervention.

A total of 70 students completed the intervention. Responses were matched so that only data from students who had completed pre and post questionnaires as well as all tasks in the workshop booklets were analysed. 11 of the students who took part did not provide sufficient information either in the questionnaires or the workshop booklets and so were omitted from the analysis leaving a total of 59 usable data sets.

It was hypothesised that the intervention would have a positive effect on student attitudes thus increasing overall scores on the SDAM.

A variety of analytical methods were used to analyse the intervention data:

- Paired samples T-tests were used to assess whether there had been any change in attitudes post intervention
- Content (tasks 1-4) and phenomenographical analysis (tasks 5-6) were used to analyse qualitative responses of the intervention activities.
- Independent sample T-tests were used to analyse task 4, the values task to determine whether there were any associations with choice of values and attitudes

Quantitative results of the efficacy of the intervention in attitude change are presented first with the analysis of the workshop booklets presented thereafter. Each of the 6 tasks are analysed individually and a summary of the outcomes of each is provided.

8.2.1 Descriptive Statistics

Upon assessing whether the data were normally distributed, the analysis revealed that there was a significant outlier. To ensure that the data were not distorted, this individual was deleted from the data leaving a total of 58 usable responses. There were low levels of kurtosis and skewness across all scales indicating excellent normal levels of distribution.

Mean scores for the ESES and the SDAM pre and post intervention were all above their midpoints, (84 SDAM and 96 ESE) respectively (122.34, 106.79, 108.72) indicating that the majority of participants had above average levels of EI and also that attitudes towards SD

were generally positive from the outset. Standard deviation results indicated good levels of dispersion across the measure as a whole.

	ESES	SDAM PRE	SDAM POST	Env Pre	Env post	Soc Pre	Soc Post	Eco Pre	Eco Post	Other Pre	Other post
Mean	122.34	106.79	108.72	25.45	26.48	28.90	29.81	26.03	25.71	26.41	26.72
SD	14.06	7.12	7.01	2.85	2.74	3.05	3.14	2.74	2.80	2.09	2.25

Table 21. Descriptive statistics for ESE and the SDAM and subscales pre intervention and post intervention.

8.2.2 Paired Samples T-tests

To assess whether there had been any change in overall attitude scores pre and post intervention, a paired samples t-test was performed. Participants' attitudes increased significantly from pre intervention (M = 106.79, SD = 7.12) to post (M = 108.72, SD = 7.01), t(57)= -2.61, p<.05). Although this result was significant, in order to determine whether this effect was substantive, the effect size was calculated rendering a medium effect size (r=.40) accounting for 16% of the variance. The hypothesis that the intervention would lead to a higher attitude score on the SDAM was therefore accepted.

Paired samples t-tests for each of the subscales of the SDAM were also performed in order to see whether attitudes in relation to the different dimensions of SD had changed.

There was a significant difference between scores for the environmental subscale pre and post intervention. Participants' attitudes increased significantly pre intervention (M = 25.45, SD = 2.85) to post (M = 26.48, SD = 2.74), t(57)= -3.53, p<.001). There was also significant difference between scores for the social subscale with participants' attitudes increasing significantly pre (M = 28.90, SD = 3.05) and post intervention (M = 29.81, SD = 3.14), t(57)= -2.708, p<.05).

The mean score for the economic subscale decreased slightly post intervention however this was not significant: pre (M = 26.03, SD = 2.74) and post (M = 25.71, SD = 2.80), t(57)= .932, p>.05) indicating that scores remained stable for this subscale.

There was a slight increase in scores post intervention for the 'other' scale however this was not significant: pre (M = 26.41, SD = 2.09) post (M = 26.72, SD = 2.25), t(57)= -.862, p>.05) again indicating that scores remained stable for this subscale.

The overall mean for ESE was quite high indicating that in general students who took part in the intervention phase typically had quite high ESE (ESES midpoint 70; M= 122.34).

Unfortunately whilst it would have been ideal here to establish whether the finding from Phase 1 that there is a statistically significant relationship between ESES and SD attitudes held true for this cohort of students, the sample size of 58 was too small to generate any statistically meaningful results.

In order that the observed effects of the intervention could be further explained, particularly as to why there was attitude change on two of the subscales and not the other two, each of the 58 workshop booklets was analysed. Each task was analysed individually and the results of the same are presented below.

8.2.3 Analysis and Results of Task 1

Table 22 depicts the definitions that students were presented with. Content analysis was performed on this data with the number of times each definition chosen counted and some interpretation of reasons as to why is provided. To the left of the table is the total number of students that chose that description as the definition that best represented their perceptions of SD.

The majority of students opted for the UK Government definition. This may have been because they had prior knowledge or they may have felt it was a trusted source and so chose it on this basis. The DETR definition, another government source came in second. Again this could have been due to the fact that it's a trusted source or they could have simply preferred the wording as the two are very similar. The Brundtland definition (the most cited definition within the literature and other SD documents) surprisingly came in third which could indicate that either students have not heard of this or they just prefer the UK Government one.

Definition	N
Development that meets the needs of the present without compromising the ability of future generations to meet their own needs - ***World Commission on Environment and Development - Brundtland 1987***	**12**
Sustainable development means encouraging economic growth while protecting the environment and improving our quality of life - all without affecting the ability of future generations to do the same - ***UK Government***	**21**
A dynamic process which enables all people to realise their potential and to improve their quality of life in ways that simultaneously protect and enhance the Earth's life support systems - ***Forum for the Future***	0
An emphasis on social, economic and environmental wellbeing for people and communities, embodying our values of fairness and social justice. We must also look to the longer term in the decisions we make now, to the lives of our children's children as well as current generations - ***Welsh Government 2011***	1
Sustainable development refers to the fulfilment of human needs through simultaneous socio-economic and technological progress and conservation of the earth's natural systems - ***A.P Sage 1998***	6
Sustainable development is all about ensuring a better quality of life for everyone, now and for generations to come, through: social progress which recognises the needs of everyone; effective protection of the environment; prudent use of natural resources; and maintenance of high and stable levels of economic growth and employment - ***DETR 2000***	**17**
Own definition	2

Table 22. Definitions of SD and results

It is interesting to note that each of the top three definitions chosen all contain key SD words such as environmental, social and economic and future generations, so choices may have been based on this. This might also explain why the Forum for the Future definition received no choice at all as there is no direct mention of social, economic or environment which they might associate with SD, making it somewhat meaningless to them.

Where students used their own definition they did not write down a full statement but rather highlighted various words within all 6 of the above statements which they thought best fitted how they perceive SD. This supports the contention as to why other statements were not chosen as certain words that students associate with SD were not contained within them. Murray (2011) posits that words we choose reflect the ideas and issues that are important to us as individuals and reflect our beliefs and values hence students may have cited for this reason or they could just be words they associate with SD.

8.2.4 Analysis and Results of Task 2

Each of the pictures presented in the workshop represented issues pertaining to SD such as water, climate change, pollution, waste, desertification and social deprivation. A framework approach was applied to the data with responses summarised and placed into a matrix by groups (an excerpt is provided at Appendix 16) and content analysis was performed on the data. The results of the analysis for each of the pictures is provided below along with the collective ranking statistics. Unfortunately some of the students did not rank each of the pictures from 1-10 attributing the same ranking to more than one picture and this is reflected within the results. It does however indicate that students view some issues to be of the same importance as each other and not less or more. Results are presented in rank order.

Picture H - Rank 1

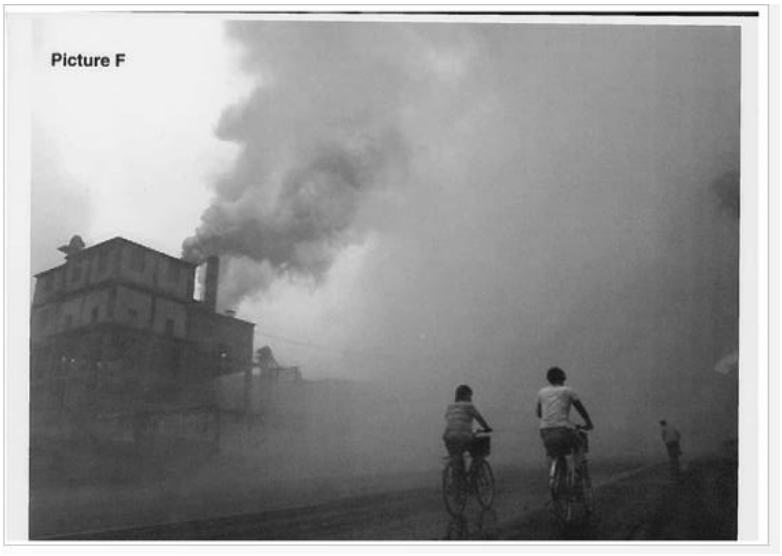
This came out as ranking highest. Students related this picture to burning fossil fuels, climate change, global warming and the environment being unstable. A couple described it as a forest fire and some related it to war. It was commented upon that war means focus is lost on SD and that it is costly, resource intensive and damages the environment.

Perhaps because the picture depicts the issues mentioned much closer to home it was given slightly more importance than the same issue in another country which is depicted in picture F described below ranked as second. One student commented that although the picture was

similar to F, it did not have the same impact as picture F as from a distance it does not look as bad. This demonstrates that our perceptions of SD issues may not always be accurate as this picture actually shows pollution very near to the students' place of study that cannot be seen on windy and cloudy days so we do not even know it is there yet it is still happening. Given these two pictures were ranked at the top it was determined that students view pollution and environmental issues as most important in relation to SD. This could be due to a number of reasons, the first being that climate change is an aspect of SD that is portrayed in the media most and so it is something that it at the forefront of their consciousness. Or it could be that the environmental aspect is focused on more within their modules. However, links to social and other environmental knock-on effects that pollution can cause were mentioned such as effects on human health, as well as natural habitats and agriculture which in turn can impact on local economic growth. Effects on future generations were also mentioned taking into consideration the social aspect of SD and that renewable energy sources are needed in order to improve air quality.

Picture F - Rank 2

This picture was ranked highly in terms of importance for SD indicating that students regard environmental concerns higher than other SD issues. The smoke in the picture was attributed to either poisonous gases being burned or a fire.



Students tended to rank this highly in terms of importance for SD due to pollution having many global effects including global warming which some commented also made them think of carbon footprint. The majority thought that the picture depicted China rather than the West pointing out the major pollution problems associated with China and the fact that there is greater pollution in developing countries (perhaps the reason they attributed this as being China). Links to the impacts that this can have were made such as the social problems it can cause e.g. smog creating poor air quality and this being bad for health, and issues surrounding global warming and the impact of activities in cities on the ice caps. This was further linked to issues such as corporate social responsibility in that businesses are still polluting with no due care to the community and that also this is uncontrolled pollution with no one taking responsibility.

Interestingly some students depicted this as being a war zone "*which is not caused by SD issues*" however at the same recognising that economic growth (part of SD) can cause civil unrest leading to war and that SD can lift the economy. Whilst they didn't directly associate war as being caused by SD they did recognise that SD can help prevent such issues.

The fact that there was surrounding infrastructure and means of life in the picture prompted some students to comment that the people who live here have a better quality of life than some (perhaps in comparison to the other pictures with relatively none of these features) but that the living standards are low and it is not sustainable. Reference was made to the 'take make waste model' in this respect and the fact that this is unsustainable and that there are ways of preventing or maintaining pollution.

Picture E - Rank – 1, 3, 4

Views clearly differentiated between students on this picture given the outcome of the ranking score however most ranked it at the higher end of importance rather than the lower end. Those ranking it highest stated they had done so due to the fact that it impacts on so many other factors such as poverty and famine with students making wider connections to the issue at hand.

Picture E

There was a unanimous ascription for the reason for the fish being dead in the picture due to pollution from waste/oil from power plants and other such facilities and that this was wasteful unsustainable manmade pollution. Some attempt was made at linking this to the wider issues with comments such as "*it proves our actions are not sustainable and nature is being jeopardized for our benefits*" as it also destroys the natural life cycle in that these fish are not just for human consumption but it affects the aquatic life cycle too. Students also made wider connections to the issues of poverty and famine in that people would not be able to feed themselves and also to economic impacts in that it would impact on the livelihood of those who fish for a living.

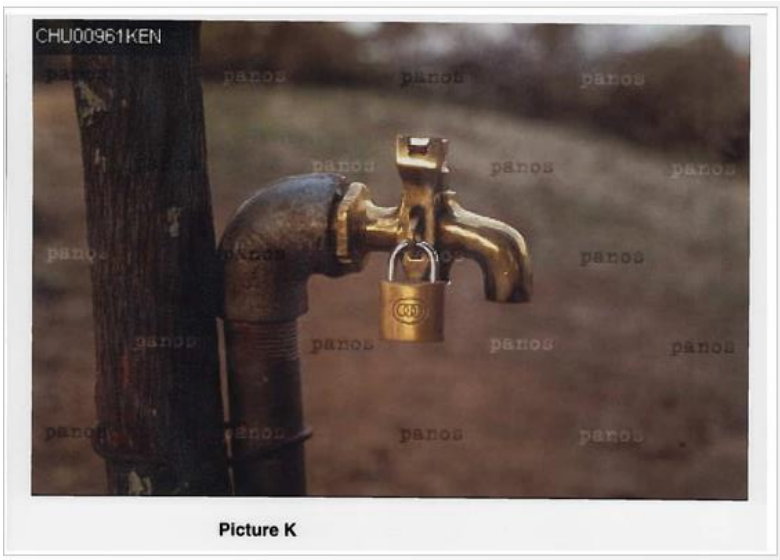
Picture N - Rank ¾

This picture was ranked as fairly important to SD. The majority referred to it as depicting a local sewage plant or water source that has been massively polluted/contaminated by toxic/hazardous waste, which in turn is highly unsustainable as it causes damage to ecology and surrounding wildlife affecting the animals that live in such environments and drink the water. Students also commented how such damage can have wider reaching social impacts in that it can also destroy people's livelihoods and cause disease and that once water is contaminated it cannot be used again resulting in highly unsustainable and wasteful practices.

Picture N

Picture K - Rank 6

This picture was referred to as the tap being padlocked due to either conservation of resources due to a drought caused by global warming or to water shortage in general and that human use of water is unsustainable.



Picture K

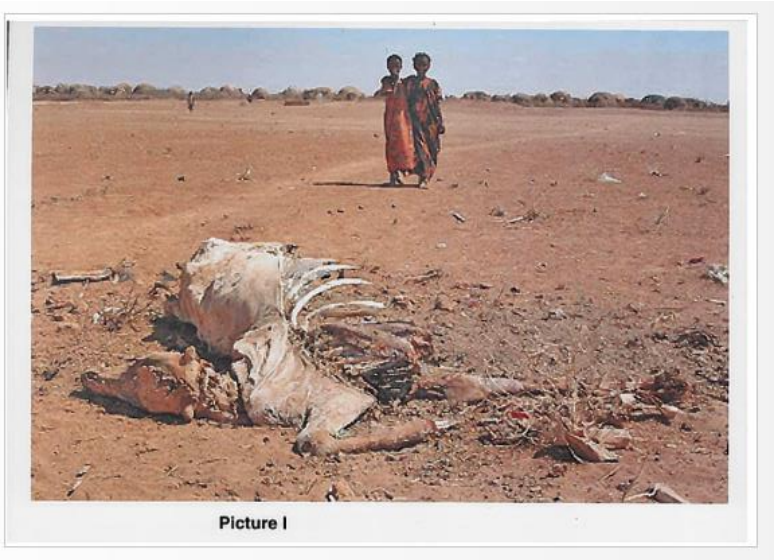
Some commented that it shows sustainable use of resources in times when supplies are low. The drought aspect was linked to the wider issues of this causing problems with not being able to grow crops and provide food and that without sustainability it will stay like this. One group mentioned possible causes of water shortage being due to domestic industry,

deforestation and bad river management. It was also commented upon that such restrictions could possibly lead to wars as people try and gain control of such resources.

Inequality was again mentioned in that people are able to have infinite amounts elsewhere e.g. in the UK. It was evident that students did not link this to being in the UK, perhaps assuming that such problems do not exist in the UK.

Picture I – Rank 7

Picture I represented desertification and this was alluded to directly and indirectly in comments such as "*over use of land*" and "*land degradation*". Views were split across the sub groups as to whether this was natural or a manmade cause of death. Most however referred to the image as depicting drought, a lack of water and vegetation caused by climate change/global warming which in turn has caused the animal to die.



Picture I

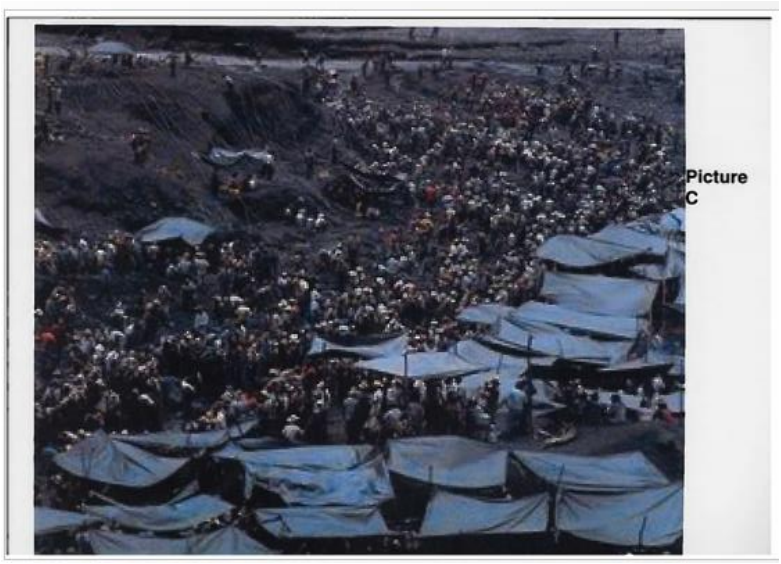
Some questioned whether the dry land surrounding the dead animal was the cause of its death and stated that it could have died of natural causes or another animal and thus not necessarily related to sustainability. Where drought was stated as a cause, in some cases students commented that drought is a natural occurrence that cannot be avoided. One student commented that it did not make them think of sustainability at all. Only a handful of students perceived that the drought was caused as a result of human activity.

Another student commented that industries such as the textile industry are more likely to be the cause of this rather than global warming.

It was stated that these conditions are unsustainable and again the interconnectedness of the issue of poverty and famine with food shortages for people living here was recognised. One student also referred to the fact that where land degradation leads to parts of the world being unable to support themselves, this leads to support being needed further afield alluding to the economic strains this puts on other countries. Indeed the UK donates millions of pounds to third world countries which in turn has a knock on effect on our economy.

Picture C - Rank 8

Students referred to this picture being one of three things: a refugee camp with the people having fled from war/political issue, slums and living in poverty or related to some sort of natural disaster. Where it was described as a result of a natural disaster, many students linked this to being as a result of climate change or global warming.



Some students gave very limited answers such as 'no housing' 'poor living standards' 'unsanitary' 'no access to resources' but no discourse as to how such conditions may have come about. It was however mentioned that such conditions are not economically or socially sustainable evidencing some recognition of the impacts of this on sustainability.

Further links to social issues were made in relation to overcrowding and how this can impact on environmental and economic issues and how there is a need to control population growth for SD. One student commented that population has the biggest impact on sustainability as it affects every other problem and that the population is too high at the moment to achieve complete sustainability. Again however another student commented that it made them think of over-population but not necessarily any relationship with SD.

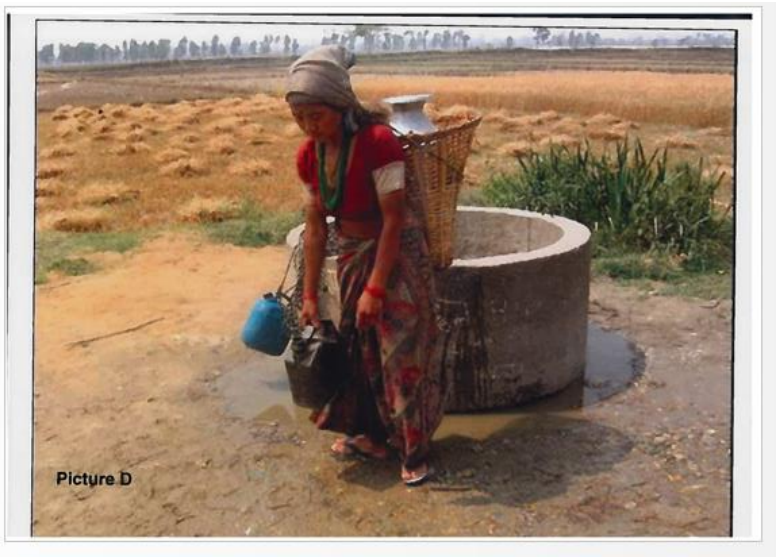
It was commented upon amongst some groups that whilst the picture depicts a massive social issue, it is not necessarily related to sustainability. Interestingly it was commented that if it is a disaster, it doesn't make you think of SD because it's not man made. If global warming which is claimed to be a manmade issue had caused such a disaster which a lot of students mentioned, then there are links here to SD. Whilst they clearly acknowledged the poverty and other social issues surrounding this, students ranked this relatively low in terms of importance for SD giving it an 8. Poverty is a major sustainability issue as identified in Chapter 2, and the interconnectedness between SD and poverty was not recognised amongst many of the groups.

The picture is in fact of an emerald mine and the people are there of their own free will in order to ascertain emeralds. Such answers therefore support Murray's contention that we tend to make assumptions/judgments based on little knowledge/evidence.

Picture D - Rank 8

This picture was also ranked eighth in the total rank scoring of all groups indicating that students attribute less importance to this issue.

There were mixed views amongst groups on this picture with some portraying it as an unsustainable issue and some as sustainable. The concept of inequality and 'third world poverty' was mentioned as a sustainability issue in that use of resources is unfairly distributed and that access to drinking water, sanitation and public health needs must be satisfied for SD and that water should be available to everyone not wasted by the privileged.



Some participants commented that they thought this was actually a more sustainable way of life as it is using one source for water rather than multiple taps drawing resources and that people using only what they need is sustainable. It was commented upon that the picture shows no signs of carbon footprints which could perhaps be interpreted as meaning this is actually a more sustainable way of life. Some saw the situation as a lack of water availability due to heat and drought however they did not link this with SD "*makes me think about poverty not SD*" again highlighting the fact that students do not view poverty as a sustainability issue. There was no attempt by any student to link the situation to first world activities/practices which may be causing the problems they described. Many recognised the investment in infrastructure needed to improve quality of life.

Picture M - Rank 9

Most saw this picture as crops that have been destroyed by flooding due to the effects of global warming/climate change and that climate change affects the seasonal changes which in turn affect the crops. There were attempts by some students to link it to other issues such as the fact that the man has no way of making money now his land is flooded which will impact on the economy and the locals as they will not be able to get food supplies and could also possibly cause them to leave their homes resulting in poverty.

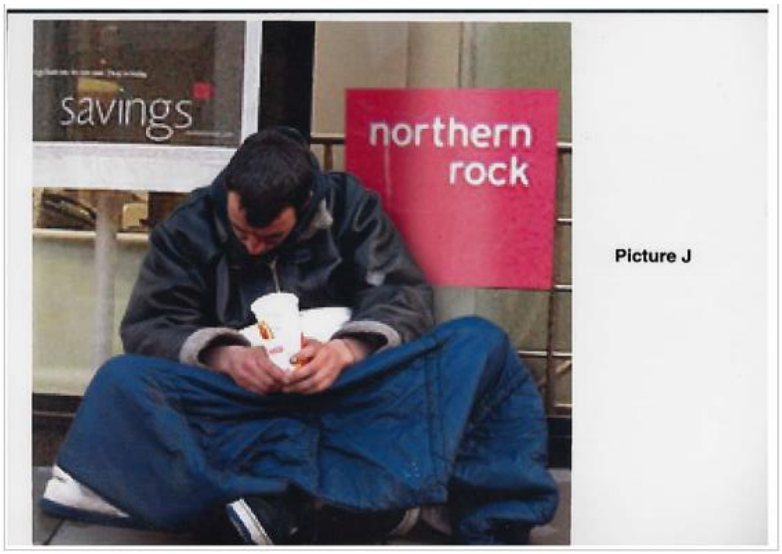
Picture M

Poverty was also linked in that there is no economic sustainability or development happening in this picture with no food or homes and that infrastructure is needed to prevent such issues. Opposing views emerged to those above with some students viewing the situation as being self-sufficient as they are living off the land and that this is sustainable as it is local, self-economy and not heavily industrialised. There was also mention of the flood being a good thing as saturated ground provides good ground conditions for growing and also for drinking, again implying that this is sustainable. One student commented that it made them think of climate change but not sustainability which is a grave concern given that climate change is central to SD. Other students provided comments such as "*looks like a natural process"* and *"no sustainable problems here".*

Students commented that the flood suggests a lack of education and knowledge on how to channel water for drinking and other uses. If infrastructure and better human management were provided the ground would be less saturated. This is an important comment as ESD is not just about educating those in the UK, but the right for everyone to have education as highlighted back in Chapter 2 and so such problems may be prevented if solutions are provided through education. The fact that this was ranked as being really low in importance to SD may be due to those who thought that the flood is actually helping in terms of saturating the land for crop growth and is thus sustainable and so not as urgent or large as the issues portrayed in the other pictures.

Picture J - Rank 10

This picture was ranked as having least importance to SD. Whilst students unanimously recognised it as poverty, they also felt that it was not as important as poverty elsewhere in the world.



A few students commented that there is no excuse in this country for people not to work and have a home. As to whether they were ascribing blame to the individual or the government is unclear. It was stated that poverty such as this has nothing to do with sustainability and has occurred due to the economic crisis and the current unstable economy.

Again it was interesting that some students view this issue as having no link to sustainability. One student commented that it didn't "*trigger the same response as other pictures*". This could be due to the fact that some of the students stated 'it is a common sight in many UK cities and thus we are perhaps just used to it. Or that there are available resources in the UK and so perhaps it is not as urgent as the other issues. Indeed one group stated that whilst they agreed the image can be as a result of sustainability "*they placed it at the bottom of the pile*". However some linked it to economic issues viewing the man as not helping towards the economy as he is not in employment which was not good for the future economy and related it to a lack of or no economic and social sustainability.

Another reason put forward for the low ranking was that first world issues are a small problem in relation to others. Basic needs such as water and food come first which this man can get, again alluding to the fact that this situation is not as severe as poverty in other pictures and he can manage and survive. Views were split on this picture with some sympathetic to the situation stating this depicts not protecting the vulnerable and homeless in need. Inequality of wealth was also referred to as another issue of social SD. Some were less sympathetic and stated that it has no reference to SD, only making them think of poverty and homelessness. Suggestions were made for resolving the situation through the investment in social housing that could help build more sustainable homes.

8.2.4.1 Commentary on the Results of Task 2

The outcomes of this task indicated that students have a reasonable awareness of SD issues. Evident within the ranking of pictures, students clearly view environmental aspects more important than social or economic issues and linked many of the causes to global warming and climate change. It was interesting to note that in the two pictures depicting pollution, it was commented that one did not have the same impact as the other indicating that if we cannot see pollution or indeed other sustainability issues they are somewhat less important. Many of the issues pertaining to SD are not visible and thus engaging students with this line of thinking is an important aspect for attitudes and perceptions towards SD.

As to interconnecting the issues, students made good attempts at doing so. For instance students commented upon how environmental damage can impact upon communities in terms of resource depletion and land damage which in turn affects the economy of the local community. No direct linkages were made between the issues and developed countries except some references made to inequality in that we have more use of resources. This is however related to the social aspect of SD indicating they grasp the broader issues. There was no attempt to link how we may be contributing to each situation or indeed to climate change. How the construction industry contributes was mentioned in a few instances but more in relation to world problems. Generally students tended to view SD as an environmental and third world issue that doesn't affect the UK. Orr (2004) posits that graduates today lack a value for land and community, something difficult to transmit through course content alone. Instead, altering how we teach, whatever we teach, can develop those

values. Students through the use of this task articulated responses consistent with an appreciation of land and community and how each impacts on the other indicating that such tasks are important for instilling such values. These results overall indicate that knowledge is a prerequisite for understanding SD issues and the wider context within which they fit and that equipped with such knowledge students are able to make informed and intelligent responses to issues pertaining to SD.

Once the students had completed this task, a brief discussion took place with the students in which they were asked to provide some of their responses to the task. They were then provided with new information by the researcher as to what the pictures actually depicted in order to challenge their thoughts and views. When it was revealed to students that one of the pictures they saw as less important was actually of a place not that far from where they are taught, this created a lot of discussion amongst students giving food for thought. In line with Zimbardo and Leippe's (1991) contention that presenting new information to provoke cognitions should increase attitude change, the author argues that this was the case in the present research and some evidence is provided for this in the evaluation of task 6 below in which students provided their accounts of their experience of the workshop. In some instances it was commented upon that a picture did not make them think of sustainability at all which is quite worrying given that all pictures depicted some form of issue relating to SD.

8.2.5 Analysis and Results of Task 3

This activity aimed to ascertain the views of students in respect of how they could achieve positive outcomes through personal empowerment. The activity required the students to discuss what influence they may have on pollution and poverty, depending on their influence and concern. The activity was carried out within small groups and through discussion the aim was to provide solutions to the problems of pollution and poverty across the world. Responses for this activity were numerous and are provided at Appendix 17. Where duplications occurred these were listed as one response. Again a content analysis was performed on the data which sought to convey students' perceptions and ideas of the ways in which such issues can be tackled.

The outcome from this task demonstrated a good understanding of some of the major concerns and issues pertaining to SD and the influence students believe they can have on resolving these issues. Where concern was large, students tended to place the issues primarily as global/large scale issues, whereas when concern was small and they believe they can have greater influence students tended to place these issues at more local and achievable levels. The results in Appendix 17 visually demonstrate that students believe there is more they can do than they cannot.

By way of an explanation for change in attitudes, the majority of answers for 'can do' tended to relate to environmental or social aspects and the can't do related to more economic and legislative factors that they cannot control. After having thought about these issues, this may have led to a shift in students attitudes as they felt more empowered to help in these areas and so their attitudes became more positive in relation to social/environmental. The fact that there wasn't much of a shift in the economic and other subscales could be explained by these results in that these are generally issues we don't have much control over and so students' beliefs are likely to have been similar prior to the intervention and remained the same.

8.3

.6 Analysis and Results of Task 4

This next task engaged students in thinking about what matters to them most i.e. on a personal level and sought to extend the emotional aspect of this intervention. Getting students to provide an honest analysis of their values and thinking whether their actions align with their values might help to reconnect them with SD. Students were presented with another circle in which they were asked to write down what they care about most starting from the centre and working their way outwards. To assist in what values they might want to consider a table of values was provided.

The top five values reported were health, family, friendship, job/career and ambition. After this, love, trust, honesty, respect, purpose in life, knowledge and financial security were chosen, many of which align with sustainability values (Murray, 2011). Appendix 18 provides a full list of the values students listed and the number of times each value was chosen and its level of importance. Many of the top values reported are intrinsic values which reflect more

caring for others and the community (Crompton, 2010) and which may reflect the positive change in attitudes post intervention. As values influence our motivation, given the majority of students valued family and friendship as most important, one might take the view that this may extend to being motivated to care more for the environment to preserve it for the future generations. Job/career, ambition and financial security are however extrinsic values which are associated with lower levels of concern about bigger-than-self problems such as SD and lower motivation to adopt behaviours in line with such concern (Crompton, 2010). The results also indicate that students' value preservation (n8) and nature/earth (n12) less compared to other values.

To establish whether there were any associations of values with attitudes, a series of independent samples t-tests were performed on the top values reported above. Based on the findings of the literature review, values reported are for one tailed tests as the researcher predicted that there would be some effect of values on attitudes. There were no significant differences in mean scores between those students who chose these values and those who did not. Whilst the top ten are those that students chose most, this is not to say that values that were less reported had any less effect on attitude scores, particularly at an individual level and thus t-tests were run for all the remaining values.

There were six values where there were notable differences between final mean attitude scores namely, bravery, fidelity, fitness, happiness, recognition and wealth. In the case of bravery, homogeneity of variance was violated and was corrected for by reporting results for equal variances not assumed. In all other cases homogeneity of variance was met and so results are for equal variances assumed. Mean attitude scores were higher for those who did not choose the value in question on all of these identified values (Table 23). These values are extrinsic (with the exception of fidelity) in that they relate to values that are contingent upon the perceptions of others, i.e. caring more about what others think rather than extending to others (Crompton, 2010) and again which may reflect why those who chose these values had lower attitude scores. For example, in relation to wealth, experimental studies have shown that a strong focus on financial success is associated with lower empathy and less concern about environmental problems (Crompton, 2010) which may explain why those who did not choose this value had higher attitude scores consistent with findings elsewhere (Saunders and

Monroe, 2000; Schultz *et al.,* 2005; Good, 2007, Gatersleben *et al.,* 2008). Again although there were no significant statistical outcomes for financial security, this was listed as a top value and it may be that students may have valued this over and above the environment reflecting the overall outcome.

Research suggests that the weight we assign to various values may depend on the role we are in at the time of making a decision (Dietz *et al*., 2005) thus thinking about values in the context of SD and in the context of their chosen professions may have promoted such thinking. It is interesting to note however that those values particularly related to SD (community, equality, justice, nature, preservation) did not appear to have any influence on the direction of attitudes post intervention. However this is from a statistical viewpoint and thus it may be the case that these values did impact on some level, just not an observable one.

Value	Chose Value						95% CI for Mean Difference		
	Yes			No					
	M	SD	n	M	SD	n		t	df
Bravery	105.93	4.70	14	109.61	7.43	44	.27, 7.10	2.19*	56
Fidelity	104.57	5.74	7	109.29	7.03	51	-.85, 10.80	1.70*	56
Fitness	106.33	5.79	18	109.8	7.31	40	-.45, 7.38	1.77*	56
Happiness	99	2.83	2	109.07	6.88	56	.234, 19.90	2.05*	56
Recognition	104.50	6.02	10	109.60	6.94	48	.37, 9.84	2.16*	56
Wealth	106.57	6.64	21	109.95	7.01	37	-.39, 7.14	1.80*	56

Table 23. Independent samples t-test and descriptive statistics for task 4
*** p < .05 one tailed**

It is suggested, albeit tentatively, that the change in attitude scores may in part be due to students evaluating and reflecting on their values impacting on their attitudes towards certain aspects of SD. Causal relations suggested here are however tentative as it is impossible to know exactly what students were thinking when choosing values, however it would appear from the analyses that there was some impact of the values task on attitudes. Caution must

also be taken with these results given the differences in sample sizes between the groups who did and did not choose the values analysed.

8.2.7 Analysis and Results of Task 5

This task asked students to think about how the built environment is important for SD and how, in their role as a professional within the discipline they are studying, they would incorporate SD. An underlying aim of this was to elicit thought as to responsibility for such actions. Thorsen (2004: p9) commented that in teaching responsibility a question that should be asked is "*What consequences does my lifestyle have for nature and for other people*?" In engaging students in this task after having discussed the various SD issues in previous tasks it was anticipated they would relate their actions to these wider issues.

8.2.7.1 Importance of Built Environment for SD

There was a shared consensus amongst students that the construction industry is extremely important for SD and has a "*huge responsibility to build sustainably and we cannot consider development without considering the built environment as part of SD*". Students acknowledged the BUE is responsible for many activities that destroy the natural environment such as mining, deforestation, all use of raw materials, energy use, including the embodied energy that goes into making a building and how the BUE can help in reduction of pollution and waste. They also alluded to the sector's importance for growth in terms of impact on the wider economic and social issues such as equal access to resources. The benefits of building sustainability were also accounted for in this task with students providing accounts in terms of reducing poverty and sustaining for future generations " *the built environment is a mechanism for countries to grow and develop*" and can create jobs particularly as more development is needed. One student pointed out that during discussions many did not see the relevance of poverty for the UK and limited this to developing countries only, highlighting the need to address the interrelatedness of how development in countries such as the UK affects poverty in third world countries.

A number of students commented that they believe, given the BUE has the greatest impact on SD, the industry has to undergo the biggest change in the way they go about achieving SD. This could be interpreted as they do not believe at present the education they are receiving enables such a change and that the status quo remains in BUE curriculum delivery. In support

of this assumption, one student commented that a greater understanding of the technology and materials would enable them to make more sustainable choices and decisions, a view that is reflected within the industry literature.

8.2.7.2 Implementing SD in their Professional Roles

In terms of how in their profession they can incorporate SD, students offered some well thought out solutions.

Construction Management students offered examples such as using more strategic procurement methods, implementing waste management systems and encouraging clients with Real Estate students suggesting that the BUE could help achieve SD through management initiatives or through refurbishment or redevelopment of the fabric of buildings.

Those on the Water Management course commented that water shortages are a sustainability issue and that it is important to incorporate sustainability in the water industry through efforts such as ensuring waste minimisation and that whole life costs in terms of carbon and energy are considered. It was stated that not just the cheapest solutions should be implemented, but the most sustainable ones and that sensible and sustainable management of resources and choosing sustainable materials/greener methods is needed.

Mixed views emerged amongst the Architectural Technology students with some believing they "*don't have a huge influence when it comes to ensuring sustainable design*" whereas other students thought the profession was extremely important and that "*Architectural Technology should incorporate sustainability into every design*". Such accounts support findings in the literature that roles and responsibilities are poorly defined in relation to SD amongst construction professions. Defining at HEI level how and where they can incorporate SD will ensure that once in industry this is no longer a barrier.

Building greener homes was offered as a solution from *AT* students "*If more homes were created from natural resources this would combat against poverty, create work and give shelter and help the environment*" and can help by material selection, advising on friendly and sustainable products and systems.

Project Management and Quantity Surveying students were less forthcoming in relation to how they can influence SCPs. Thinking from a costs perspective, these students commented that SD should be looked at from whole life cycle perspective in terms of materials energy and waste cost and how in doing so can in the long run bring many advantages.

Clients and costs were mentioned in relation to job roles but more so as a barrier in that industry clients look to keep costs down rather than make sustainable choices which is very much in line with the findings in the literature and FGs in phase 2. However students also recognised their responsibility and the influence they have to educate and encourage clients to explore sustainable solutions "*it is up to industry to provide clients with information as to how more sustainable solutions could save them money, we have the power to influence the client in what materials should be sourced and where from*" and that "*we need to educate clients in what ways can make buildings sustainable, we need to get clients to want to put sustainable systems in their buildings and not just feel they have to*". The FG findings revealed that in industry this information is hard to come by and the challenge for HEIs will be in educating students as to how they advise clients. This will involve as students stated, providing costs and materials information for example to enable them to advise clients on ways to reduce energy usages so that the best solutions can be offered in order to make sustainable decisions. Quantity surveyors in particular can have an influence in this respect such as helping towards carbon targets by taking into account future costs estimates and helping clients to allocate realistic proportions of budget to comply with sustainability requirements. Given the lack of responses from this cohort for this task, this is something that could perhaps be more emphasised on quantity surveying courses.

Those who work in industry stated that they don't have much control in respect of SD *"to some extent however the company that I work for dictate how I consider the environment. I believe it will have a positive impact and I can see the benefits however I am restricted to costs and specification in my job role (just do as I am told!) and unfortunately do not have much influence. The workshop was good, I realise there is so much we can do, it is just difficult in seeing how".* It was also mentioned that it is particularly difficult in the current economic climate and that whilst the concept of SD is ideal, companies are under pressure to keep costs

down and the general perception is that SD solutions tend to take longer which can affect the project/programme incurring further cost.

Reiterating the findings from the FG results, students also referred to the responsibility of Government in enforcing SCPs *"I believe Government and boards should make the construction process become green*". They also believed that such Government guidelines would help have a positive impact and increased co-operation within industry. Such comments support the FG findings that industry very much takes its lead from Government.

In terms of impact on attitudes, having students reflect on how they can achieve SD through their roles may have further empowered them in respect of a 'can do' attitude. Again most of the answers proffered related to solutions to environmental aspects and could explain the increase in scores for this subscale. Many commented that they would use what they have learned to encourage and incorporate more sustainable technology and design into their practice and that they also understood the reasons for doing so particularly in how this impacts on poverty and future generations which could have had an effect on the shift in attitudes on the social subscale.

The reference to the costs barriers and the fact that they have no control towards being able to adopt and implement SD in their places of work and thus cannot influence in this aspect may explain why attitude scores on this subscale stayed fairly consistent. Given the comments pertaining to Government it is surprising that there was not more of a shift in attitudes on this scale. However it could be the case that these beliefs were held consistent as per the circles task in that these are much larger issues which they feel they cannot influence.

Six key main points arose from the analysis of this particular task:

1. Students believe that the BUE is important for achieving SD;
2. Students believe that the industry can improve and change its ways;
3. Students recognise the ways in which SD can be achieved i.e. through design, materials, waste, procurement but that more guidance is needed;
4. Students acknowledge how this can create a more competitive market;

5. They understand how in their professional roles they can implement SD and their responsibility for doing so but guidance is needed in this respect also;
6. They believe they require further understanding of how to set about designing and constructing sustainably.

8.2.8 Analysis and Results of Task 6

This last task aimed to evaluate students' overall views of the workshop and how they felt it had impacted upon them. This was done by means of a reflective exercise. Reflection leads to individual growth and interpretation of the greater meaning and implications of an experience or action (Branch and Paranjape, 2002) and was thus hoped to further provoke thought as to their beliefs and values regarding SD further facilitating attitude change.

The majority of students reported that the workshop had made them think differently about SD overall. Some stated that it had not 'changed' their beliefs or views as such but added to them and made them realise that the effects of SD are perhaps larger than they initially thought:

"The workshop made you think outside the box and not just about subjects we have been taught. There's more to SD than what I thought…the workshop helped open up your mind and look at the different ways that sustainability is portrayed"

"*It made me think of the wider picture".*

Many remarked that it had helped raise awareness of poverty and the link to SD which they didn't see prior to the workshop extending SD beyond the environmental aspect and educating that it is also about people and caring for the environment which in turn means also protecting the livelihoods of many which in turn has an economic impact. A number of comments arose from students supporting the author's contention that understanding SD as a whole is paramount to achieving SD with the social element clearly having the most impact on students. A number of quotes are provided below in order to illustrate and emphasise this point:

"It made me think more about what is sustainability in reality, and the link to poverty…the workshop has helped me to look at sustainability and poverty in different aspects, not just to design a building and just add solar panels etc. There is more to sustainability than I had originally in mind in terms of other countries and situations."

"The workshop made me consider what I am doing and how it might affect the environment and others…it made me think about what is being done by myself and construction not only when building but how and where the materials are sourced from."

"The workshop made me realise how important and realistic it [SD] is becoming and also showed me areas of sustainability I never assumed would be considered. It made me more concerned and has definitely encouraged me to try and become more involved."

"The workshop made me consider more about the effects the built environment has on the world and I will try to be more aware when designing in the future."

"The workshop provided good insight about what SD is and showed all of the different situations that people are in around the world."

"*It made me think of the broader picture…my views have not really changed but it has made me think about how others can also be affected."*

In relation to the economic aspect, this appeared to also impact on attitudes but adversely. Discussing and thinking about the costs implication of SD may make them feel there is not much they could do about this situation and thus may have negatively impacted on attitudes. The comments provided in task 5 by students in relation to this aspect support this contention. As mentioned in Chapters 2 and 6, cost is a major barrier to SD implementation with students already acknowledging this fact. Working collaboratively may help students across all disciplines come to effective solutions. Thinking about these issues and how in their roles as construction professionals they can impact on this both positively and negatively seemed to have a positive effect on the students:

"It [the workshop] has made me think about when I am in industry I need to make sure I make a difference".

"The workshop impacted me by making me think more about sustainability and will affect me in future projects by my material selection and make me look more into certain aspects. My views have changed as I wasn't too bothered before but now I believe I have a duty and to play my part and to try and help bring in more sustainable methods."

"My views have changed. I agree strongly with the Government quote at the start. It has made me realise how design can affect SD but working together can with other disciplines developments can become more sustainable not just in energy ways but economic ways as well."

It was clear that there were strong feelings towards SD amongst many students and that this is perhaps something that they do not get to discuss. The benefits of the workshop allowing them to express their views on SD and that the chance to debate these issues was much welcomed and that more exercises like this should be embedded into the curriculum:

"The workshop has made me reflect upon the issues of sustainability and I have come to the conclusion that it should be discussed more frequently in construction education."

Follow up discussions have been shown to be a powerful tool for attitude change. Authors such as Bage (1997) and Wade and Poole (1983) have found that involving learners in an analysis or critique of instruction and messages presented lead to attitude change. McClellan (1996) also contends that constructing learning environments to ensure that students feel their opinions are important and valued is important in the learning process and is a view endorsed by the author given the student feedback.

Students were of the view that it is important for SD to be incorporated into BUE degrees and the importance of this in developing future leaders:

"The workshop made me consider sustainability in respect of the built environment but also on a personal level and in general I feel strongly about this subject and think it is important as a major module in degrees for future managers and post graduates who will be building the future schemes and buildings."

This comment also evidences how thinking about SD on a personal level can impact on their feelings towards SD. In support of the arguments put forward for task 5 that students need to be educated as to how they influence SD in their roles, those who have no industry experience commented:

"*I know problems exist but having not worked in industry I don't fully understand how it can incorporated into the world"*

Something that all students bar one reported was that in some way they had gathered an improved perception of SD:

"The workshop gave me excellent insight into the current sustainability issues. My awareness has definitely enhanced as a result."

"The workshop made me realise a number of factors make up sustainability not just pollution. My views on sustainability have increased as to the requirement for SD."

"The workshop has put a picture to my thoughts on SD, it has deepened my thoughts on the concept of SD, my beliefs are not necessarily in line with my actions because of current working procedures and cost realities."

"The workshop made me feel that I do not know enough about sustainability and I that I need to broaden my understanding…overall the workshop made me realise SD is a bigger problem than I thought."

Thinking about SD from a personal perspective as advocated by Murray also appeared to have an effect on students:

"the workshop made me think more about the social and economic side of SD rather than just the environmental…it also showed me that as an individual I can contribute to sustainability through everyday activities."

The contention that providing realistic accounts and media also helps to strengthen attitude change was supported through comments such as:

"The picture task was interesting, especially the picture showing the Wirral, it showed different examples of pollution from around the globe. As a result I now think more needs to be done regarding sustainability and development."

The answers elicited during the reflection task indicate that the intervention had a positive impact on the students and changed their perceptions of what SD actually is with many now grasping it as a holistic concept. This in turn appears to have changed their attitudes in relation to SD as evidenced by the comments above. A summary of the outcomes of the intervention overall is provided below.

8.3 Discussion

This chapter provided a brief snapshot of BUE students' responses to a brief educational intervention around SD. The results indicate that it is possible to foster positive attitudes towards SD through the means of educational interventions. The results presented indicate that not only did the intervention increase the attitudes of students' towards SD, but the qualitative analysis of the workshop booklets provides strong evidence in support of the effectiveness of the intervention.

The outcomes identified that students' perceptions towards SD changed and that most now believe in the construction sector for achieving SD and that the construction industry has the potential to be at the vanguard of SD. Many of the statements from students were perhaps in the views of some a utopian view, but what was clear from the responses is that they do believe that we as individuals have the power to have an impact on SD, whether this be from a personal or a professional perspective evidenced by statements such as "*The built*

environment is a major industry and how we plan and build contributes to and affects the environment. If every individual considers the environment and people there can be significant change".

This phase of the research has highlighted the importance of student engagement with SD issues and demonstrates that placing SD in a personal rather than a professional context is an effective method of eliciting attitude change. In doing so this would perhaps ensure the consistency between the attitudes and values implicit in an educational curriculum and those characteristic of a particular profession which Carter (1985) emphasises.

Whilst the success of this intervention is extremely promising, the main barriers to SD however lie within industry and thus establishing whether this tool is suitable for use with industry professionals forms the next part of this research which is detailed in the next chapter.

Overall the workshop helped students to identify how the BUE is important for all aspects of SD and was successful in enabling students to grasp SD as a holistic concept and not just about the environmental issues. Looking at and discussing the different scenarios and how they relate to SD showed students the many other problems that relate to SD not just environmental, and that perceptions are not always right and that providing the right information can help to change perceptions "*I have been shown how people's perceptions can change depending upon how much information is known about certain situations*".

8.4 Summary

- The outcomes of the intervention indicated that student attitudes increased post intervention supporting the use of alternative pedagogies for ESD.

- The use of meditated messages such as pictures which target the learners' cognitions and emotions were also supported by the outcomes of the intervention.

- The adoption of a personal approach to SD targeting values, beliefs and emotions in conjunction with the above pedagogies appears to be a winning combination for a successful intervention.

- Students now understand sustainability as a holistic concept and not just about environmental issues and the impact that they as professionals can have in contributing to the agenda.

9. Phase 4 - Testing of the Educational Intervention Tool

The last and final phase of this research involved the testing of the tool developed and piloted in phase 3.

In order to evaluate the usability of the tool with industry, a FG was conducted with culture and behaviour change consultants who work within the construction industry.

To evaluate the feasibility of the tool, principles of usability testing were undertaken. Usability testing is a technique used to evaluate interventions through the exercise of having users directly test it to see if it accomplishes its intended purpose and if it is easy to use. The purpose of the process is to elicit qualitative feedback to understand how users interpret the content and to allow for iterative modifications (Kushniruk, 2002; Dickerson *et al*., 2013). Obtaining qualitative feedback from individuals who may use the materials can provide valuable information and determine if an intervention will be effective and achieve its purpose (Currie, McGrath, and Day, 2010; Thompson *et al.,* 2012). Usability testing has been widely used for web based evaluations (Yardley *et al*., 2010) and also for evaluating medical interventions for health improvement interventions (Dickerson *et al*., 2013) and service settings (Akin *et al.,* 2013).

9.1 Sampling and Participants

Through the researcher's contacts, five participants were recruited via telephone to take part in a FG to discuss the usability and suitability of the tool for industry. Criteria for inclusion in the FG were professionals working in industry who have knowledge of developing materials for the sector and the challenges faced in achieving culture and behaviour change, and who could review the tool from the perspective of construction professionals. All participants were consultants who work within industry as culture and behaviour change agents. All have previously worked in industry prior to becoming consultants and so have industry experience also. They were chosen to validate the tool for industry use as in their roles as consultants they develop materials which they use in workshops and presentations they conduct with their clients. Their areas of expertise are detailed below in Table 24. Four of the consultants agreed to take part in the FG.

Participant 1 AA	Environmentalist and sustainability
Participant 2 AS	Lean construction
Participant 3 TW	Business improvement and development, Building information modelling (BIM)
Participant 4 KH	Procurement and bid writing, leadership and management, interview skills

Table 24. Phase 4 focus group participants' areas of expertise

9.2 Procedure

The FG took place at the premises of participant 3 as this was the most convenient to all. Prior to the discussion, the researcher took the participants through the workshop booklet task by task explaining the purpose of each one and the format that took place during the workshop. The next step of the FG was to go through each task individually and discuss each task in turn. To elicit their feedback on the intervention, the participants were asked a set of open ended questions, asking them to think out loud while viewing each task, asking what thoughts come to mind and what should be added/taken away or suggestions for improvement.

9.3 Results

There were a number of issues that participants raised as to the relevance of the tool for use within industry and a number of things that would need to be taken into consideration for adapting the tool for use within an industry context. Figure 17 provides an illustration as to the key words that were elicited from the analysis as what needs to be considered for achieving change within an industry context and these are discussed below.

Overall, participants felt that the intervention would not 'move industry on' and that at present, it only "*captures their current thoughts and feelings as to how they feel right now based on their sets of values*". It was stated by one participant, that at present, the tool is an approach that has been developed which demonstrates that the methods used therein have an impact, but that this would need to 'built on'. It was felt that the intervention felt like the 'middle part' of a much wider programme and that for any change to occur, industry would need to be 'taken on a journey': *"To me this is the middle bit, you've got to present or get them to tell you what their understanding of SD is then take them on that journey through this".* This comment as to 'taking them on a journey' was something that was expressed by all participants and was felt strongly amongst the group with another participant stating that

a baseline would need to be established followed by something a bit more in-depth and a bit more rigorous.

The first thing participants suggested in relation to making this a wider programme was that an introduction to SD at the beginning would be needed in an industry context as whilst students who had undergone the intervention have been programmed to already start thinking in that mentality, many in industry have been out of education for a while and there are still misconceptions as to what SD actually is. It was stated that this could potentially lead to people not understanding what was being asked of them and that we need to 're-programme' industry that it is not just about the environmental aspect but to consider SD from a holistic viewpoint, but that they would need this explicitly put forward to them as to what the three dimensions are. It was stated that in doing so, this would also form an evidence gathering exercise as to what their understanding of SD actually is. Participants also commented based on their experience of facilitation that in an industry context, a lot more structured guidance and knowledge transfer would need to be provided throughout the workshop. For example in relation to the values and beliefs aspect, this would also need explaining to individuals to put it into some context for them.

It was also felt that going straight from task 4 (the values task) into asking them how the intervention made them think and feel was too much of a jump and that something more in between would be needed to facilitate the journey: *"…you kind of jump from task 4 to 5, you've done the kind of who are we, challenged their beliefs and started to elicit what their beliefs and some of their attitudes are and then you've said that having done that how does that make you feel about what have you learned and I just wonder whether is that a bit of a step too far within this given that as we said you want to take them on a more detailed journey".* One suggestion as a solution to adding "*something that actually tries to create the shift"* was to perhaps build in scenario based exercises as part of the workshop which ask people to make a choice between certain products, some which are sustainable and some which aren't and ask them why they made those choices and see if their choices align with their values.

Figure 17: Word Cloud: Targeting Industry

It was felt that with these additional elements, that rather than seeing a one step increment change in responses on the attitude questionnaire, there might be a 2 or 3 step increment change heading towards more positive answers. It was also highlighted in relation to the attitude questionnaire, that this would be a really effective profiling tool that would help to differentiate those who are more altruistic from those who are more 'egotistical' setting a baseline for the right people to target within industry.

As to the individual tasks themselves, participants were asked to provide their opinions as to each. In relation to task 1, participants felt that in addition to a priming task, this could also be used to identify individual differences in perceptions of SD by incorporating more definitions that relate to the separate elements of SD i.e. the social, economic and environmental aspects. In addition, it was stated that this would also help to identify initial understanding of SD at an organisational level. It was also suggested that doing this task prior to an introduction to SD presentation to gauge their initial understanding and perceptions would further help to challenge their perceptions for the remainder of the workshop as the knowledge transfer progressed: "*So if you tell them it's about the other elements too and then say now you tell me what you believe SD to be".*

In relation to whether they thought industry professionals would engage with the pictures task (task 2), initially there was some questioning regarding the pictures themselves, why they

were chosen and what it was they were trying achieve and "*do they really capture all the aspects of SD*" but overall after some discussion and further clarification, the participants understood that the pictures were used to challenge the students perceptions of SD and agreed that actually this task actually had the strongest influence of them all as it really provoked thought: *"Oh absolutely I agree with you because the more I think about it actually I think those images have been chosen because they provoke a reaction".*

In relation to task 3, the circles of influence and concern, one participant commented that this is a tool they have in their own repertoire of tools and have found extremely useful for helping people to understand how they can influence and control areas of concern that they have in relation to a number of topics. In particular when individuals say that they cannot do something, it is highlighted that that is a concern in itself and then you take them through that process of highlighting the parts that they can influence and control which then start to impact on the concern creating change. Whilst initially some of the participants didn't understand the task, again once it was further explained to them, it was agreed that this is a useful task to have but that it would be better if it was adapted to focus on participants' professional roles and issues within their organisation as regards to SD rather than on more wider issues of poverty and pollution. In response to this, the researcher asked if this should perhaps then replace task 5, and rather than ask them to write down how they feel in their professional roles they can contribute to SD, to use the circles of influence instead to which it was replied that this would work better with industry participants.

In relation to the last task of reflecting on the workshop, participants felt that going straight from task 4 into asking them how the intervention made them think and feel was too much of a jump and that something more would be needed to facilitate the journey such as the incorporation of scenarios based exercises as discussed above.

From the discussions with the FG it was evident that for the intervention to be effective in an industry context, it would need to be adapted. As such, it was necessary to assess how long such an intervention would need to be. It was stated that the intervention would need to be a minimum of half a day and that it would need perhaps more than one session to elicit any effective change in attitudes. It was also emphasised that whilst the intervention could be

pitched as a workshop which individuals from different organisations come to, if the purpose of the intervention is to change culture and behaviour then it would need to be at an organisational level, not individuals because otherwise you have one person from a lot of companies going back to their organisations having changed themselves but it's the way the company works that needs to change for SD to be achieved.

Overall it was agreed that the intervention is suitable for industry but not in its current form and that it would need building upon to provide a more rigorous programme for industry with three key elements for success highlighted. The first being knowledge transfer so as to dispel any conceptions as to what SD is and to start the beginning of 'the journey'. The tool could then be implemented followed by scenarios based exercises to help to put it into context for them. Figure 18 below provides as illustration as to the elements of the journey that industry need to be taken on.

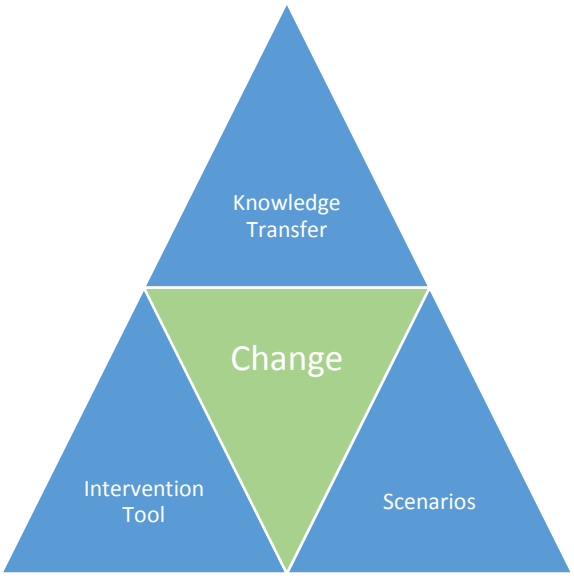


Figure 18: The Journey for Change

9.4 Summary

- The content of the intervention was deemed suitable however, it was also believed based on their experience of conducting intervention programmes with industry, that for any real change to take effect, the materials would need to form part of a wider programme lasting around half a day to a full day to have any real impact.

- As part of a wider programme, the tool and the tasks therein are something that they would use themselves as consultants and believe would be effective.

- There is still very much a lack of understanding of what SD actually is and that in this respect industry would need to be taken on a journey of SD.

- Recommendations put forward for improving the intervention were:

    - Provide a wider range of definitions incorporating sole aspects of SD to tease out greater individual differences

    - Conduct a brief introduction to SD on the 3 dimensions to challenge current perceptions

    - Include the use of scenarios based exercises

    - Provide more guidance and knowledge transfer

- Any change will need to be at an organisational level as individuals will 'disappear' in an organisation

10. Discussion and conclusions

10.1 Discussion

The lack of adoption of SCPs is well documented within the literature and many Government documents. Whist efforts are being undertaken by both Government and HEIs, progress remains slow if being made at all. FGs conducted with industry professionals revealed that the view across industry is very much that unless SD is legislated or there is greater client demand, it simply will not happen. The barriers which were identified in the literature review manifested themselves within the FG discussions supporting the fact that despite efforts these barriers still remain. The lack of response to phase 1 of this research by industry further evidences the barriers that exist within industry in relation to sustainability with phase 2 indicating that there are significant business and organisational barriers.

When asked what they believe would need to be done to change this, the response was very much that if it is not legislated it will need to be driven through education. As discussed in Chapter 2, efforts are being undertaken to include SD within the curricula yet this has proven rather difficult in practice. There is also still very much a focus on the environmental aspect with the social and economic aspects often ignored. If we are to succeed in implementing SD, then all 3 dimensions must be taken into account. This will entail ensuring that graduates are not only sustainability literate but are conversant in all 3 areas of SD and understand the impacts that each has on the other.

The outcomes of this research highlighted that a focus on HEIs and clients is needed in order to drive SD within industry, yet industry itself should not be ignored. There are many other elements of the status quo which impede progress and need to be tackled such as 'preferred supply chain' and other 'preferred' methods of working. A deep cultural and behavioural shift needs to be achieved within industry in this respect. Indeed it was commented on by the FGs in phase 2 that education alone will not be sufficient enough as new graduates will not have enough influence, and that ultimately whether a company adopts SCPs lies with those running the business. In this respect, the aspect of leadership for SD is vital if we are drive it at an organisational level as needs to be the case as highlighted in phase 4. This is achievable as researchers such as Fergusson and Langford (2006) have shown that when

managers place high value and exercise positive attitudes on the environment and its protection, organisations are more likely to adopt sustainable practices, even those that are subject to strong institutional pressures such as the construction industry. As today's students will replace those who are in their twilight years, it is vital that we in-still in them the leadership skills necessary to exercise such positive attitudes in relation to all aspects of SD and ensure that they too do not become a barrier.

As clients become more educated about the building process, this may affect such preferences as they start to demand where products and services come from themselves. As Häkkinen and Belloni (2011) point out, "*The demand and willingness of clients eventually determines the development of sustainable buildings. This demand is closely related to issues such as supply, knowledge, methods, and costs and value*" (p243). These are issues which need to be addressed at both industry and HE level.

The feedback from the students in Chapter 8 supports this as they too highlighted that it is their responsibility to inform clients yet they lack the knowledge how to do so. It is vital that students are trained in this respect if we are to send them into industry with a focus on SD. The need to educate clients is clearly a driver for SD and methods for doing so need to be implemented expediently. For clients to be educated, we need an educated industry and for an educated industry we need educated graduates. Recommendations for industry and HEIs working together in developing programmes that mutually reflect traditional teaching and more current industry thinking in construction curricula are strongly advocated. Government agendas ultimately shape the direction of industry and should also be considered within HE construction curricula.

In order for ESD to be successful, it has been advocated that new pedagogies are required. In particular, new teaching methods that move away from teacher-focused transfer of knowledge formats, such as lecturing to more student focused formats. This research answered to these calls within the literature and adopted a SCL approach which also focused on including aspects that are integral to SD such as values. This was met with the success of an educational intervention which was successful in changing the perceptions of students' attitudes towards SD. The findings from this study highlighted that students very much view

SD as an environmental issue and one which does not necessarily affect the UK. Through the discussion of SD issues and the wider more connected issues, students' feedback indicated that they now see SD as more than just environmental and are beginning to grasp SD as a holistic concept. This also served to strengthen their views as to the importance of SD and the importance of construction for SD.

The results of phase 3 of this research evidence that adopting learner-centred methodologies as described back in Chapter 7, produce effective improvements in attitudes towards SD as well as improving knowledge of SD issues. Whilst knowledge alone is not enough for attitude change, it is a prerequisite for attitude change. The knowledge disseminated during the intervention clearly had an impact on students' attitudes towards SD. However the findings indicated that it was more than just the imparting of knowledge which led to the successful outcome. The recommendations by Murray and others that we need to personalise SD and that different methods of teaching are required played an influential role in the outcomes of phase 3 of this research. The comments provided by students evidence this. The outcomes of the values task, albeit tentative, indicate that there is some worth in thinking about our own values in attempts to change attitudes towards SD. As was highlighted in Chapter 7, values consistent with SD are responsible for shaping our intrinsic motivation (Kollmuss and Agyeman, 2002) thus if we align our values to SD we are likely to be more motivated to carry out sustainable actions.

In order to achieve the deep cultural and behavioural shift needed, the field of psychology has been heralded as an area of significant interest. Indeed as Corral-Verdugo *et al*. (2010) stated, investigating the psychological dimensions of sustainability is an important step in beginning to understand factors which predispose us behave sustainably and design interventional strategies aimed at encouraging people to behave in accordance with sustainability. In particular the role of emotions in driving SD forward is seen as integral to SD efforts. It was identified in Chapter 3 that EI is linked to many areas that are important for SD, in particular that of leadership and project management as well as general academic success. The finding in phase 1 of this research that higher levels of ESE were associated with more positive attitudes towards SD, strengthens the argument that ESE may be an important factor in the pursuit of achieving SD. Having high levels of EI does not necessarily mean that

this will translate into action therefore individuals with high levels of ESE would perhaps be more suited in leadership roles where SD is concerned as they possess not only the ability but the self-efficacy to utilise these qualities. Equipping students with such skills as they embark on their professional careers will be imperative to achieving SD.

The aim of this research was to investigate various avenues that could assist in moving the SD agenda along. The adoption of a mixed method approach was fundamental to answering which methods would be best suited to achieving the objectives and overall aim of the research. The quantitative phase of this study in Chapter 5 showed that students generally had above average levels of ESE indicating that not only do they have good levels of EI but that they feel able to utilise these abilities. This finding may be of extreme importance in developing the skills and attributes needed to produce SD minded graduates and indeed industry professionals. Incorporating ESE as part of student development programmes could be extremely positive in creating graduates who are not only equipped with the skills and knowledge of SD but also with the personal attributes that are needed in driving it forward.

Only through the use of qualitative methods in phase 2, was the researcher able to obtain rich descriptions of industry's current thoughts as to SD and what they believe can be done to improve efforts. As Dainty (2007) has highlighted, construction research has a heavy reliance on quantitative methods. This research adds evidence and provides support for the use of qualitative and mixed method approaches in construction and education research.

The use of a mixed model approach in phase 3 was fundamental in helping to understand and explain potential reasons for the success of the intervention. As pointed out by Abrahamse *et al.* (2005), studies on interventions tend to only report whether the same have been successful and not the reasons why. The quantitative findings evidence that the intervention was successful but the qualitative analysis attempted to explain why. This in turn highlighted which parts of the intervention were most useful and impacted on students the most.

10.2 Conclusions

The overarching aim of this research was to propose an educational tool that may be used both within the construction industry and HE to promote more SCPs. This aim was achieved through the achievement of the objectives set out in section 1.2. Each of these objectives and how each one was achieved are reviewed in turn below.

The first objective was to gain an understanding of SD within a construction context including the impacts of industry and the barriers and drivers towards the adoption of SCPs. This objective was fully met through a review of the literature which set the scene as to what SD is and how it sits within the context of the BUE. The review revealed that the construction industry is of significant importance to SD, not just in terms of the negative impacts it creates, but also the many positive impacts it can create but that there is a lack of momentum within the construction industry to adopt sustainable practices despite much acknowledgment of the need to do so. The findings indicated that this appears to be due to the many challenges that industry face in implementing SD including a number of barriers such as cost, ambiguity in relation to policy and legislation, a lack of understanding and knowledge of SD and a lack of clarity as to clearly defined roles and responsibilities. Based on these findings, it was concluded that there is an urgent need to change industries attitudes towards the challenges that they face as well as the need to educate the construction sector on sustainability if we are to see widespread adoption of sustainable practices.

The next objective sought to identify current Government and educational practices regarding SD to gain an understanding of what is happening in relation to promoting SD amongst industry and HEIs. This was met through a further literature review which established that there have been a number of Governmental drives for SD over the years including initiatives such as A21/LA21, a number of Government Strategies which have been in place since 2005, as well as a number of high profile international summits. The 2011 and Construction 2025 strategies have both placed increased pressure on industry in terms of reducing its environmental impacts and becoming a more 'efficient' industry, yet as the outcomes of objective one identified, this pressure is simply not enough and more needs to be done. It could be inferred from the lack of uptake and innovation in this respect that again a lack of knowledge and understanding is impeding progress. The GCB has begun to map out the skills

and training gap within the sector however alone this may not be sufficient and there is much that can be done through new recruits to the industry.

Upon reviewing the HE landscape, it was established that there have been international efforts to promote ESD yet uptake and implementation remains problematic and patchy at best. In addition, much of the focus has been on that of the environmental aspect with the social and economic aspects often overlooked. Similar problems, much like those that the construction sector itself face, appear to be thwarting efforts such as a lack of understanding and confidence amongst academics due to the contested nature of SD. There are 111 HEIs in the UK providing BUE courses providing much opportunity for SD to be driven through these institutions with knowledge and research translated into industry where graduates with the skill and know how have the means to be very influential in leading the future. It was concluded from these findings that there is much to be in done in relation to upskilling and educating both the decision makers of today and tomorrow and that in particular, the social and economic aspects of SD need to be given more attention.

The third objective of establishing what psychological constructs might be useful for attitude change was achieved in Chapter 3 through a review of the attitude and individual differences literature. In particular it was established that the interrelatedness of attitude components is a very complex one and a change in one component can result in a change in another, thus each of the 3 components of attitudes (cognitive, affective and behavioural) need to be taken into account. It was highlighted that in order to strengthen attitude change, in particular the affective component should be targeted. This was due to factors such as that when the affective and cognitive components are targeted, attitudes formed are generally stronger and also that it is more effective to change attitudes that are more emotionally based than solely cognitively based. It was also argued within the literature that the affective domain may indeed be the most important component and perhaps the primary dimension of behaviour. This provided a strong case for targeting emotions which lead to a review of the EI literature from which it was determined that there are clear strong links between EI and leadership which is vital for SD. There were also links to many other aspects which could be vital for SD including academic success, project management, positive work attitudes, occupational success as well as the fact that those that are more in tune with their emotions appear to

have more positive values and beliefs towards the environment and by extension the other pillars of sustainability.

From a review of other constructs that may be useful, it was established that Optimism looked promising in that people are more likely to succeed in identifying ways of overcoming obstacles if they hold an optimistic orientation with more future-oriented individuals also found to be pro-environmentally oriented persons, again extremely important for SD. Also, it was found that that people with higher levels of optimism tend to work harder at relationships. This is a particularly important aspect in relation to SD, as given the many different professions that have to come together to work on projects, ensuring the success of a project and indeed the implementation of SD, requires a collaborative environment which requires good working relationships. All of these factors made a strong case for including it within the research. More importantly, it was established that both of these psychological constructs can be developed in individuals which is extremely promising given the demonstrable links within the SD, leading to the decision to use these constructs within the research.

The fourth objective was to establish what measures exist for measuring attitudes towards SD to allow for testing the hypotheses as to whether any relationships exist between SD attitudes and the psychological constructs identified in Chapter 3 of the research. From a thorough literature review it was determined that only measures pertaining to the environmental aspect of SD existed. This lead to the subsequent development of the SDAM in Chapter 5 and the achievement of objective three. Through the creation of the measure, this enabled the objective of testing the aforementioned hypotheses to be met. This was achieved through the conducting of a pilot study with BUE students at LJMU and a subsequent replication study to test the reliability of the measure and the generalizability of the results. Both of these studies returned extremely promising results, with the measure obtaining high reliabilities and an association found between ESE and attitudes towards SD. A further study was then conducted with industry professionals in order to ascertain whether these results held true for this cohort. The SDAM retained its overall high reliability and a positive association was found between the economic subscale and ESE indicating that those with

higher levels of ESE tend to favour the environment over economic gain and see SD as a way to be profitable and drive economic growth. No further significant relationships were found between the ESES and the SDAM. Each of these studies ultimately led to the successful completion of phase 1 of the research and full achievement of objective four.

Through achieving this aim, the results also add to the scant body of literature that exists with regards to student attitudes as was identified in the introductory chapter. The results demonstrate that in general students are more positively inclined towards SD however they are hindered by a number of barriers as described in the outcomes of phase 3. Most notably that SD is a topic that is not high enough on the agenda of the curriculum and that most would welcome the opportunity to develop their knowledge and skills in this area.

The fifth objective to conduct FGs with industry professionals in order to identify areas for development through their knowledge and experience was achieved in Chapter 6. Three FGs were conducted within industry. The findings corroborated the earlier literature review findings with regard to the many that barriers that exist towards SCPs. In particular, all participants stated that clients and cost are the greatest barrier to adoption and that unless SD is legislated or clients start to demand it more it simply won't happen. Another outcome from this investigation was that at industry level, SD needs to be driven from the top as unless those that are currently running the industry, i.e. the decision makers, are on board with SD again it simply won't happen. This finding supports the author's earlier contention in Chapter 3 that we need leaders who are engaged with the SD agenda and that such leaders tend to be individuals who have higher levels of EI supporting the inclusion of EI within the research.

When probed further as to how they thought that SD could be achieved, so as to inform the development of the intervention, it was highlighted that SD would predominantly need to be driven through new recruits to the industry i.e. through graduates as the behaviours and attitudes of those currently in industry are too entrenched and again unless forced to by legislation or regulation, the majority will and do not participate in SCPs. The results from the FGs provided further insight into the culture and behaviour of the construction sector and that much work lies ahead in respect not only in respect of changing the minds of industry,

but that of clients also. Due to the lack of forthcoming suggestions from the groups as to how we many overcome these barriers, this objective was only met in part. However this lead to the researcher focusing the remainder of the research within the HE sector which formed the third phase of the research.

Based on the finding in Chapter 6 that one aspect for achieving attitude change was the need to target HE, assessing what methods of teaching and interventional techniques would be useful for eliciting attitude change became the next objective of the research to inform the development of the intervention. This coupled with a re-review of the attitude literature from Chapter 3 revealed that a number of pedagogical approaches exist which have been advocated for use in ESD, namely SCL, reflective exercises and post activity discussion which all lead to 'deep learning' also advocated in the literature, as well as the use of mediated instructional methods such as imagery. It was also found that adopting a 'personal approach' to SD through the targeting of values and beliefs, would be conducive to the aim of achieving attitude change. The conclusion of these findings of adopting a personal approach to SD targeting our values, beliefs and emotions in conjunction with the recommended pedagogies provided a strong case for a successful intervention and met the full achievement of this objective.

The contention that SD needs to be personalised and our values and beliefs targeted was very much supported by the outcomes of phase 3. The results of the intervention indicated that through adopting this approach coupled with the various pedagogies recommended for ESD ultimately lead to an increase in attitude scores and the development of a successful intervention tool. In addition, the alternative pedagogies were also favoured by the students with many expressing that they do not get enough opportunity to voice their views and opinions in relation to such issues and very much welcomed the opportunity. Such comments suggest that allowing group discussion to take place was an important factor in the success of the intervention and in eliciting attitude change again supporting the literature in this respect.

The last objective of the research was to test the usability of the intervention within industry. This was met in phase 4 of the research through the use of a FG with a group of consultants

who work daily with construction professionals in a range of areas focused on culture and behaviour change. A number of questions were put to the group as to the content of the intervention and the level it was pitched at. They were also asked to provide their comments as to whether they believed the types of activities would be appropriate for this target group.

Overall the participants deemed the content of the intervention suitable but that it would need some modification if it were to be used with industry professionals. Based on their own experience of conducting interventions with industry, it was recommended that for any real change to take effect, the activities would need to form part of a wider programme lasting around half a day to a full day to have any real impact. A number of recommendations for modifying the intervention were put forward including the provision of a wider range of definitions incorporating solely each aspect of SD in order to tease out greater individual differences as well as the inclusion of a brief introduction to SD on the 3 dimensions which would seek to challenge participant's current perceptions of SD. This would also form part of a knowledge transfer process aimed at providing guidance for industry which was deemed as an absolute necessity, as industry are still very primitive in some instances as to their knowledge and understanding of SD particularly from a holistic perspective.

A last and final recommendation was to include the use of scenarios based exercises which would seek to challenge them in the process so that by the end of workshop they might actually go away and take some new behaviours away with them, as it was thought that the intervention does not do this enough currently. The overarching outcome of this was that industry need to be taken on a journey from start to finish in order for any real change to occur. Based on these outcomes, whilst the tool requires modification for use in industry, it was deemed that this phase of the research was a success and that through taking on board the guidance and recommendations provided, the tool could ultimately be very successful in driving SCPs within the sector.

10.3 Contribution to Knowledge

This research adopted a novel approach through the integration of knowledge from three separate disciplines: construction, psychology and education from which three contributions to original knowledge were made. The first was the development of a measurement tool to

measure attitudes towards SD which enabled the psychological constructs to be tested against measures of attitudes towards SD. The finding that the measure was valid and reliable is an extremely important development as it will allow future research to assess which aspects of SD are favoured over others and those less favourable could be targets for increasing awareness, training and curriculum design. It will also allow for other psychological constructs to be tested to investigate whether other associations exist which may be useful for attitude and behaviour change. The SDAM should thus be of benefit to a broad range of practitioners working across the construction industry and HEIs. The second contribution was that through the testing of these constructs, it was established that ESE is a factor that is associated with more positive attitudes towards SD and thus ESE should be considered in curricula design and professional development/training courses particularly those that include leadership roles. Given the strong links between EI and leadership, ESE could be an instrumental factor in driving the SD agenda along. The final contribution to knowledge of this research was the development of an educational intervention tool which was successful in eliciting a positive attitude change amongst students supporting the need for alternative pedagogies to be implemented for ESD.

10.4 Limitations

Despite the success of the SDAM in achieving high reliability as a whole measure, the reliabilities of the environmental and economic subscales failed to meet acceptable levels. Item total statistics indicated that if certain statements were dropped this would increase these levels however this was not enough to bring the scales to acceptable levels. The low reliabilities may be due to items in these subscales not measuring attitudes and certain items might not conceptually fit with the other statements. The generation of items during questionnaire development requires considerable pilot work to refine wording and content (Rattray, 2006). The SDAM would benefit from a factor analysis in this respect in order to determine which items need taking out or revising and to improve the reliability and validity of the measure.

Establishing whether any difference in attitudes between students and professionals existed would have added an important facet to this research however due to the poor response rate from industry, this was not possible. Whilst it could be argued that the sampling population

of students was a limitation, Shepherd *et al.,* (2009) noted that using student samples was permissible when looking at psychological phenomena.

Phase 2 of this research was not exhaustive and at best reflects a very small proportion of industry given the sample size. Yet some credence can be taken in that views were consistent across three very different sectors of industry allowing for the findings to be generalized albeit tentatively. A wider inquiry with different stakeholders may well produce different findings to those reported here.

Ideally the intervention in phase 3 would also have been conducted with a greater number of students and across other disciplines however this was not possible given the time constraints within the research. The part of the research would also have benefited from a replication study within another institution to validate the findings however again time constraints did not permit this. In addition, it should be noted that the tool only targets individual attitudes and does not consider organisational barriers which Is beyond the scope of this research.

10.5 Future work

Despite the success of the SDAM in achieving high reliability as a whole measure, the reliabilities of the subscales therein indicate that the measure would benefit from a revision. It is recommended that items which lower the reliabilities within the subscales and the measure overall are revised. A wealth of literature exists pertaining to SD and construction and so seeking out the best statements to develop a solid and reliable measure of attitudes to SD should be an ongoing endeavour. In addition, as previously suggested, conducting a factor analysis would benefit the measure. It may also be worth considering the development of a separate measure that takes into consideration the target audience i.e. students and industry as their attitudes may differ dependent on the knowledge they have which may have been reflected in the low reliability of the economic subscale.

This research has been driven from the theoretical aspects of Individual Differences, including that of ESE. The intervention phase was developed in the context of psychological theory, with reference to psychological principles and practice which target various aspects of

individual differences i.e. beliefs, values, emotions, motivation and cognitive processes. The constructs and the measures utilised in this research were adopted in order to tap into the range of individual differences that are likely to impact on and consolidate attitude change. Due to the success of the interventions, it is recommended that new ways of teaching are considered, and that these are firmly embedded within the theoretical aspects of individual differences outlined within this research, particularly that of SCL. Greater emphasis on discussion and reflection should also be considered in designing ESD curricula. Whilst it is impossible to overhaul the curricula entirely, integrating these aspects will do no doubt be of benefit in achieving the mind-set necessary for graduates to enter industry with a focus on SD.

In an attempt to address the barriers to SD that have been identified here and elsewhere, the tool could also be adapted within HE to include a number of other activities. For example, tasks that involve students assessing the cost of SD against more traditional methods and modules that include the legislative aspects of SD so that this becomes less of an ambiguous issue. Government agendas ultimately shape the direction that industry takes, as has been evidenced by the uptake of BIM across the sector. The same course of action needs to be taken with regards to SD. It may also be prudent to include scenario based exercises that involve client/industry role play so that students become familiar with advising clients as to SD options and hone their advisory skills.

Whilst educating students is absolutely necessary, there is also a pressing need to educate those who presently make the decisions, as climbing the career ladder to the decision making stage may take some time for tomorrow's decision makers, time which the environment does not have. As identified in Chapter 6, SD needs to be driven through legislation, education and leadership. A top down approach is required in this respect, targeting high level decision makers and instilling the kinds of values in these individuals needed for SD so that decisions are based on the needs of society and not solely on the needs of the organisation. This tool has the potential to achieve this. Taking this into account, future work in this area should consider adapting the intervention for use with industry professionals, particularly those who ultimately make the decisions so as to engage with the sustainability agenda. As per the

recommendations set out in Chapter 9, the inclusion of an introduction to SD to dispel misconceptions as to what SD is would be the first step in achieving this.

Given that it was identified that champions of sustainability tend to be individuals with high levels of EI, industry may benefit from undergoing EI training particularly for those who are in positions of leadership. In relation to students, this could be integrated as part of their personal development plans so as to ensure that upon leaving industry, those aspiring to be in positions of leadership within construction have not only the academic attributes to lead industry, but the personal attributes to drive industry towards a sustainable future.

As was stated in the opening chapter, the BUE provides the context for most human activities with a constructed environment necessary for society to live, work and fulfil social and other needs. We need to educate society also as to the urgent need for sustainability and how they as consumers and users of the BUE can contribute to this. In this respect, the tool also has the scope to be adapted for a wider range of audiences, particularly that of society in general. Whilst ultimately 'the demand and willingness of clients eventually determines the development of sustainable buildings', ultimately consumer demand drives client need. It is therefore quite possible that if the tool is adapted and targeted at industry consumers, particularly that of householders, this could drive SD from the bottom up.

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Appendix 1 **Environment**	Please indicate on a scale of 1-5 how you rate the question item (1 being weak and 5 being strong) and provide any comments you may have in the box provided next to the item
1. Global climate change will be a major problem for future generations unless the construction industry adopts sustainable practices	
2. We cannot slow the rate of climate change	
3. Factoring waste into the design of buildings is important for reducing unnecessary use of natural resources	
4. All materials * in construction processes(development?) should be sourced locally	
5. Only sustainable materials should be used in building development	
6. Refurbishment of existing buildings should be always considered before new build is undertaken	
7. The construction industry has an extremely important role to play in the protection of the environment	
8. The construction industry is depleting the worlds natural resources at an unsustainable rate	
9. The impact the construction industry has on the environment has been exaggerated	
10. The ultimate solution to environmental problems depends on drastic changes in the way the construction industry operates	
11. If the construction industry continues to consume more energy and materials than can be reproduced and emit more emissions that can be absorbed the industrial system will become ecologically unsustainable	
12. Environment and climate change are relatively low priorities in the construction industry	
13. Solutions to environmental problems are strongly correlated with increasing environmental awareness and environmental education	
14. Technological advances in the construction industry means that we can continue to use natural resources as one will balance out the other on an environmental level	
15. Modern science and technological advancements will solve our environmental problems	
16. Modern science and technological advancements will NOT solve our environmental problems	
17. We cannot keep counting on science and technology to solve our environmental problems	
18. Environmental problems have always existed and been solved so there is no need to worry about sustainable development	

19. The construction industry should use renewable energy and recycled materials when they are readily available	
20. The benefits of a built environment are more important than the pollution that results from production and use	
Social	
1. The reduction of worldwide poverty is important for sustainable development	
2. Sustainable development will contribute to the reduction of poverty	
3. The built environment has a vital role in the reduction of poverty	
4. More emphasis should be placed on reducing poverty when considering sustainable development	
5. Protecting peoples' jobs is more important than protecting the environment	
6. Protecting the environment is more important than protecting peoples' jobs	
7. Implementing sustainable practices such as retrofitting will provide more job opportunities	
8. Sustainable development is important for the creation of more jobs for people	
9. The construction industry should do more to minimise noise water and spatial pollution for communities	
10. Environmental degradation from construction activities has a negative impact on the health of individuals	
11. Preserving nature is important because of what it can contribute to the pleasure and welfare of humans	
12. Human well being cannot be sustained without a healthy environment	
13. Degradation of the environment through construction activities means that people in poor countries are unable to provide for themselves	
14. Communities can benefit from sustainable development	
15. Involving communities in sustainable development can promote sustainability	
16. Sustainable development is as much about the children in the future as it is about what we need today	
17. Education for sustainable development emphasizes respect for human rights	

18. Every girl or boy should receive education that teaches the knowledge, perspectives, values, issues and skills for sustainable living in a community	
19. Using more resources than we need is a serious threat to the health and welfare of future generations	
Economic	
1. The benefits of implementing sustainable practices in the construction industry do not outweigh the economic costs	
2. The costs of implementing sustainable practices far outweigh the benefits	
3. The construction industry is too significant a source of financial investment to take risks on implementing sustainable practices	
4. Unless costs savings can be evidence and achieved businesses will not adopt sustainable practices	
5. Adoption of sustainable practices can lead to costs savings and greater profits	
6. The construction industry can still make a profit whilst adopting sustainable practices	
7. Implementing sustainable practices is too risky from a costs perspective	
8. It is all right for humans to use nature as a resource for economic purposes	
9. Humans do NOT have the right to damage the environment just to get greater economic growth	
10. We should no longer use nature as a resource for economic purposes	
11. The question of the environment is secondary to economic growth	
12. It is easier and more cost effective to adopt practise that can be seen as unsustainable	
13. Adopting sustainable practices is only worthwhile if it reduces costs/increases profits	
14. Protection of the environment is more important that economic growth	
15. Companies that are environmentally sustainable are more likely to be profitable over the long run	
Other (Policy, Legislation, Education)	
1. Reporting sustainability business plans and achievements will lead to companies gaining a competitive edge in the market	
2. The Government should be leaders in sustainability and the environment	

3. The Government should bear sole responsibility for environmental protection/sustainability	
4. Governments should control the rate at which raw materials are used to ensure that they last as long as possible	
5. The Government should provide stronger guidelines on sustainable development and associated practices	
6. Better planning and management of projects would lead to more sustainable practice	
7. Sustainable design should always include reuse and recycling	
8. The reuse and recycling of materials in buildings can contribute significantly an environmental, economic and social level	
9. Solutions to environmental problems are strongly correlated with increasing environmental awareness and environmental education	
10. Laws regarding water usage should be stricter	
11. Industries should be held financially responsible for any pollution they cause	
12. Corporate social responsibility is irrelevant to sustainable development	
13. Sustainable development does not require *that businesses *to behave responsibly	
14. The construction industry is of vital important to sustainable development	
15. We need stricter laws and regulations to protect the environment.	
16. Sustainability is impossible to achieve so we should just carry on with normal practice	
17. Responsibility for implementing sustainable practices in industry lies with everyone	

Appendix 2

Dear Sir/Madam,

I am one of Alison Cotgrave's PhD students. I am conducting a questionnaire survey to test the reliability of a measure I have developed along with testing whether there are any associations between the measure and psychological constructs.

I ask that I may attend your class/lecture in order to disseminate my questionnaire amongst your students. The students will be required to complete 3 questionnaires in total. The process should take around 15-20 minutes.

I thank you in anticipation of your kind assistance.

Kind regards,

Michelle Brennan

Appendix 3

INFORMATION SHEET FOR PARTICIPANTS

Name of Researcher and School/Faculty

Michelle Brennan, School of the Built Environment, LJMU

You are being invited to take part in a PhD research study. Before you decide it is important that you understand why the research is being done and what it involves. Please take time to read the following information. If there is anything that is not clear or if you would like more information please ask. Take time to decide if you want to take part or not.

1. What is the research study about?

The aim of this study is to ascertain attitudes towards sustainable development within the built environment.

2. Do I have to take part?

Participation in the study is completely voluntary and you are not obliged to take part. If you do take part you will be asked to provide consent. You may withdraw from the study at any time you wish and you do not have to provide a reason.

3. What will happen to me if I take part?

You will be asked to complete some questionnaires, one pertaining to attitudes and one pertaining to emotional self-efficacy. Completion of the same should take no more than 15 minutes. You will also be asked to provide some demographic information including your age, gender, course and level of study.

4. What are the possible disadvantages and risks involved, if any?

There are no disadvantages or risks in taking part.

5. What are the possible benefits of taking part?

The outcomes of this study may help to inform sustainability literacy education at both higher education and professional level thus providing for better teaching delivery of such issues. The increasing focus around sustainability issues by both government and industry may mean that those better informed of the same will be at advantage in both the jobs market and client market. Results of your answers and feedback on the same can be provided upon request should you be interested.

6. Will my taking part in this study be kept confidential?

All information provided will be kept strictly confidential. You do not have to provide your name on any of the questionnaires and your signature on the consent form can be just your initials if you wish. Signed consent forms will be kept separate from any information you provide. All information will be securely held by the researcher. Any information provided, data collected and electronic recordings will be securely stored and will be destroyed by shredding or electronic deletion after a minimum of 4 years of completing the study.

7. What will happen to the results of the research study?

The results of the research will be used for a PhD dissertation, which may be published in an academic journal. You will **not** be identified in any report or publication.

8. Has this study been approved by an ethics committee?

This study has gained ethical approval from the Liverpool John Moores Research Ethics Committee (REC).

9. Who should I contact with enquiries about this study?

Any questions that you have about your participation, withdrawal, role in the study or in general, should be addressed to Michelle Brennan, the principal researcher **and/or Dr Alison Cotgrave, Principal Supervisor.**

Michelle Brennan, School of The Built Environment, Liverpool John Moores University, Henry Cotton Building, 15-21 Webster Street, L3 2ET M.Brennan@ljmu.ac.uk

Dr Alison Cotgrave, Deputy Director of School of The Built Environment, Liverpool John Moores University, A.J.Cotgrave@ljmu.ac.uk

Sustainable Development Attitudes Measure

The statements below relate to sustainability within the built environment (which includes everything in your surroundings that are man-made such as buildings, houses, roads, parks etc.). Please read each statement carefully and indicate to what extent you agree or disagree by circling the number that best represents your attitude toward that statement. **If possible please AVOID using 'Neither Agree nor Disagree' as your answer. If you are leaning more towards one end of the scale please choose this answer. There are no right or wrong answers. Your knowledge is not being tested.**

Response Options

1: Strongly Disagree
2: Disagree
3: Neither Agree nor Disagree
4: Agree
5: Strongly Agree

1. Global climate change will be a major problem for future generations unless the construction industry adopts sustainable practices	1	2	3	4	5
2. Companies that are environmentally sustainable are more likely to be profitable over the long run	1	2	3	4	5
3. Corporate social responsibility is irrelevant to sustainable development	1	2	3	4	5
4. Materials in construction development should always be sourced locally	1	2	3	4	5
5. Sustainable development can contribute to the reduction of poverty	1	2	3	4	5
6. It is all right for humans to use nature as a resource for economic purposes	1	2	3	4	5
7. Better planning and management of projects would lead to more sustainable practice	1	2	3	4	5
8. Using more resources than we need for the built environment is a serious threat to the health and welfare of future generations	1	2	3	4	5
9. Sustainable development is as much about the children in the future as it is about what we need today	1	2	3	4	5
10. Unless costs savings can be evidenced and achieved, the construction industry will not adopt sustainable practices	1	2	3	4	5
11. The Government should be leaders in sustainability and the environment	1	2	3	4	5
12. Modern science and technological advancements will solve our environmental problems	1	2	3	4	5

13. Involving communities in sustainable development can promote sustainability	1	2	3	4	5
14. Protection of the environment is more important than economic growth	1	2	3	4	5
15. Sustainable development does not require businesses to behave responsibly	1	2	3	4	5
16. Refurbishment of existing buildings should always be considered before new build is undertaken	1	2	3	4	5
17. Communities can significantly benefit from sustainable development	1	2	3	4	5
18. Implementing sustainable practices in the construction industry is too risky from a costs perspective	1	2	3	4	5
19. The Government should provide stronger guidelines on sustainable development and associated practices	1	2	3	4	5
20. The construction industry has an extremely important role to play in the protection of the environment	1	2	3	4	5
21. Humans do not have the right to damage the environment in order to get greater economic growth	1	2	3	4	5
22. Solutions to environmental problems are strongly correlated with increasing environmental awareness and environmental education	1	2	3	4	5
23. Modern science and technological advancements will not solve our environmental problems	1	2	3	4	5
24. The impact the construction industry has on the environment has been exaggerated	1	2	3	4	5
25. Sustainable development should create and provide jobs at a local level	1	2	3	4	5
26. Reporting sustainability business plans and achievements will lead to companies gaining a competitive edge in the market	1	2	3	4	5
27. The construction industry is of vital importance to sustainable development	1	2	3	4	5
28. Sustainability is impossible to achieve so the construction industry should just carry on with normal practice	1	2	3	4	5

Emotional Self-Efficacy Scale (ESES)

Using the rating scale below please read each statement and rate your confidence in performing each function/how confident you are that you can perform each function.

1 = Not at all confident 2 = Somewhat unconfident 3 = Neither confident nor unconfident 4 = Somewhat confident 5 = Very confident

Number	Statement	Response
1	Understand what causes your emotions to change	
2	Correctly identify your own positive emotions	
3	Know what causes you to feel a negative emotion	
4	Realize what causes another person to feel a negative emotion	
5	Realize what causes another person to feel a positive emotion	
6	Correctly identify when another person is feeling a positive emotion	
7	Figure out what causes another person's differing emotions	
8	Use positive emotions to generate good ideas	
9	Recognize what emotion is being communicated through your facial expression	
10	Notice the emotion your body language is portraying	
11	Generate the right emotion so that creative ideas can unfold	
12	Notice the emotion another person's body language is portraying	
13	Change your negative emotion to a positive emotion	
14	Figure out what causes you to feel differing emotions	
15	Understand what causes another person's emotions to change	
16	Help another person to regulate emotions when under pressure	
17	Correctly identify your own negative emotions	
18	Know what causes you to feel a positive emotion	
19	Help another person calm down when he or she is feeling angry	
20	Correctly identify when another person is feeling a negative emotion	
21	Get into a mood that best suits the occasion	
22	Create emotions to enhance cognitive performance	
23	Regulate your own emotions when close to reaching a goal	
24	Create a positive emotion when feeling a negative emotion	

25	Use positive emotions to generate novel solutions to old problems	
26	Recognize what emotion another person is communicating through his or her facial expression	
27	Create emotions to enhance physical performance	
28	Help another person change a negative emotion to a positive emotion	
29	Calm down when feeling angry	
30	Regulate your own emotions when under pressure	
31	Help another person regulate emotions after he or she has suffered a loss	
32	Generate in yourself the emotion another person is feeling	

IMPORTANT – PLEASE PROVIDE DEMOGRAPHIC INFORMATION

Age/Gender	
Course (e.g. Building Surveying/Construction Management)	
Part time/Full time	
Do you currently work in industry? If so state occupation	
Do any of your modules contain a sustainability component?	YES NO

Thank you for taking the time to complete the questionnaires. Your assistance is much appreciated.

Appendix 4

Dear NAME

I am one of Alison Cotgrave's PhD students at LJMU. I have been provided with your name as a point of contact in the hope that you may be able to assist me in my research. It would require you to take 10-15 minutes at the beginning of one of your lectures/seminars to distribute 2 questionnaires details of which I set out below.

I have developed a questionnaire pertaining to sustainable development in a construction context and have piloted the same at JMU with built environment students. I have also given them a psychological measure to assess whether emotional self-efficacy is correlated with such

attitudes. The results of the pilot were very promising with high reliabilities for the measure I developed and the correlations with the emotional self-efficacy scale were statistically significant. I am looking to further validate my measure and obtain a more robust data set for my research by generalising the results to a wider population of built environment students across the UK. This includes all built environment and architect students.

The results of this research could be important for training industry professionals and students in both sustainability and emotional intelligence which is known to link with leadership skills and also educational success.

I will send hard copies in the post with pre-paid return envelopes as conducting electronically doesn't seem to generate a good response rate. I approached 230 students directly at JMU and got 226 usable questionnaires back for my pilot. I appreciate this is a busy time of year and thank you for any assistance you can provide.

I look forward to hearing from you,

Kind regards,
Michelle Brennan
PhD Research Student
Built Environment LJMU

Appendix 5

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age of Student	170	18	48	23.09	5.681
Valid N (listwise)	170				

Gender of Student

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	178	78.8	86.0	86.0
	Female	29	12.8	14.0	100.0
	Total	207	91.6	100.0	
Missing	System	19	8.4		
Total		226	100.0		

Correlations SDAM and subscales

Correlations

	SDAM Total	Environmental Subscale Total	Social Subscale Total	Economic Subscale Total	Other Items Total

SDAM Total	Pearson Correlation	1	.739**	.862**	.743**	.845**
	Sig. (1-tailed)		.000	.000	.000	.000
	N	226	226	226	226	226
Environmental Subscale Total	Pearson Correlation	.739**	1	.543**	.372**	.454**
	Sig. (1-tailed)	.000		.000	.000	.000
	N	226	226	226	226	226
Social Subscale Total	Pearson Correlation	.862**	.543**	1	.516**	.675**
	Sig. (1-tailed)	.000	.000		.000	.000
	N	226	226	226	226	226
Economic Subscale Total	Pearson Correlation	.743**	.372**	.516**	1	.530**
	Sig. (1-tailed)	.000	.000	.000		.000
	N	226	226	226	226	226
Other Items Total	Pearson Correlation	.845**	.454**	.675**	.530**	1
	Sig. (1-tailed)	.000	.000	.000	.000	
	N	226	226	226	226	226

**. Correlation is significant at the 0.01 level (1-tailed).

Reliability Environmental Subscale

Reliability Statistics

Cronbach's Alpha	N of Items
.608	7

Reliability Economic Subscale

Reliability Statistics

Cronbach's Alpha	N of Items
.522	7

Reliability Social Subscale

Reliability Statistics

Cronbach's Alpha	N of Items
.739	7

Reliability Other Subscale

Reliability Statistics

Cronbach's Alpha	N of Items
.783	7

		SDAM Total	Lot Total Scores	Emotional Self-efficacy Scale Total
SDAM Total	Pearson Correlation	1	.089	.113*
	Sig. (1-tailed)		.092	.046
	N	226	226	226
Lot Total Scores	Pearson Correlation	.089	1	.377**
	Sig. (1-tailed)	.092		.000
	N	226	226	226
Emotional Self-efficacy Scale Total	Pearson Correlation	.113*	.377**	1
	Sig. (1-tailed)	.046	.000	
	N	226	226	226

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Correlations SDAM Subscales and Psychological Measures

Correlations

		Emotional Self-efficacy Scale Total	Lot Total Scores	Environmental Subscale Total	Social Subscale Total	Economic Subscale Total	Other Items Total
Emotional Self-efficacy Scale Total	Pearson Correlation	1	.377**	-.044	.142*	.113*	2*
	Sig. (1-tailed)		.000	.257	.016	.044	.017
	N	226	226	226	226	226	226
Lot Total Scores	Pearson Correlation	.377**	1	-.075	.090	.133*	.131*
	Sig. (1-tailed)	.000		.132	.088	.023	.025
	N	226	226	226	226	226	226
Environmental Subscale Total	Pearson Correlation	-.044	-.075	1	.543**	.372**	.454**
	Sig. (1-tailed)	.257	.132		.000	.000	.000
	N	226	226	226	226	226	226

Social Subscale Total	Pearson Correlation	.142*	.090	.543**	1	.516**	.675**
	Sig. (1-tailed)	.016	.088	.000		.000	.000
	N	226	226	226	226	226	226
Economic Subscale Total	Pearson Correlation	.113*	.133*	.372**	.516**	1	.530**
	Sig. (1-tailed)	.044	.023	.000	.000		.000
	N	226	226	226	226	226	226
Other Items Total	Pearson Correlation	.142*	.131*	.454**	.675**	.530**	1
	Sig. (1-tailed)	.017	.025	.000	.000	.000	
	N	226	226	226	226	226	226

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Reliability SDAM

Cronbach's Alpha	N of Items
.717	28

Reliability Environmental Subscale

Cronbach's Alpha	N of Items
.108	7

Reliability Social Subscale

Cronbach's Alpha	N of Items
.602	7

Reliability Economic Subscale

Cronbach's Alpha[a]	N of Items
-.483	7

Reliability Other Subscale

Cronbach's Alpha	N of Items
.540	7

Correlations for professional study

		SDAM Total	Emotional Self-efficacy Scale Total	Environmental Subscale Total	Social Subscale Total	Economic Subscale Total	Other Items Total
SDAM Total	Pearson Correlation	1	.094	.807**	.760**	.692**	.845**
	Sig. (1-tailed)		.199	.000	.000	.000	.000
	N	83	83	83	83	83	83
Emotional Self-efficacy Scale Total	Pearson Correlation	.094	1	.113	.032	.288**	-.062
	Sig. (1-tailed)	.199		.154	.386	.004	.288
	N	83	83	83	83	83	83
Environmental Subscale Total	Pearson Correlation	.807**	.113	1	.500**	.491**	.529**
	Sig. (1-tailed)	.000	.154		.000	.000	.000
	N	83	83	83	83	83	83
Social Subscale Total	Pearson Correlation	.760**	.032	.500**	1	.296**	.523**
	Sig. (1-tailed)	.000	.386	.000		.003	.000
	N	83	83	83	83	83	83
Economic Subscale Total	Pearson Correlation	.692**	.288**	.491**	.296**	1	.502**
	Sig. (1-tailed)	.000	.004	.000	.003		.000
	N	83	83	83	83	83	83
Other Items Total	Pearson Correlation	.845**	-.062	.529**	.523**	.502**	1
	Sig. (1-tailed)	.000	.288	.000	.000	.000	
	N	83	83	83	83	83	83

**. Correlation is significant at the 0.01 level (1-tailed).

Appendix 6

1. Knowledge – what they actually know about sustainability	**Things I want to cover – use as prompts if not covered**	**Notes**
What do you understand by the terms S/SD? **What immediately comes to mind when you think of the terms S and SD** **Think of 3 three words associated with SD/S**	• Just a buzz word? Important? • Familiarity - superficial knowledge or in-depth? • Aware of the 3 dimensions? Meaning of each provided? • Definition provided? Brundtland? • Meaning provided? • Words associated with? • Issues surrounding it? Climate change etc. • Technology mentioned? To what extent do they think it will help? Solve it? • Purpose? What SD/S sets out to achieve? (Minimize environmental impact • Enhance life cycle performance • Enhance recycling/renewable application • Enhance resources usage efficiency • Improve reliability and performance • of materials and systems • Improve energy efficiency • Improve design practices • Quality of products • Improve or maintain quality of life • Safety)	
2. Own perceptions of Sustainability		**Notes**
What would you say has informed your perceptions of S/SD? (What's influenced them – how did they get there – how did they come about these perceptions?)	• Work/Occupation • Government • Lectures, media, • Does their company engage/implement any S practices?? If **NO** - reasons for this? • Anything they do in personal life? (Eat seasonal produce/organic food • Prefer products with eco-labels. • Recycle/use recycled product • Turn lights off	

	• Use less energy/energy saving technologies in the home? Light bulbs? Wear extra layers of clothing rather than put heating on? *Is this to save money rather than concern for environment* • Use public transport/cycle rather than drive? • Waste avoidance? Carrier bags – reuse or have for life bag • Do you ever point out unsustainable behaviours to anyone?) • Brought up with it • Worthwhile? Necessary? Beneficial? • Are the a clear advocate/passionate or not bothered	
3. **Perceptions of how they think industry is adopting sustainability**		**Notes**
What are your thoughts about the construction industry and S/SD?	Do they think CI can help? Should it help? How? Doing enough already? Could do more? How? Extent CI contributes to S issues? ENV IMPACT • responsible for high-energy consumption (50% of all worldwide energy usage), • solid waste generation, • global greenhouse gas emissions, external and internal pollution, environmental damage • resource depletion including water consumption IMPORTANCE FOR S: • One of the biggest industries that can make a difference to S • Environmental protection • healthier built environment and ecological systems, • energy conservation/improve energy efficiency • better comfort, • waste reduction, • resource conservation, • better service life prediction and enhancement • ensuring quality of life for future generations •	

	What Industry can do: • Waste reduction • Use less energy – via? • Import/use locally sourced materials • reduce carbon footprints, ecology and environment protection, • healthy indoor and outdoor environment, water use reduction, energy • efficiency, eliminating environmentally harmful materials, • improve resource efficiency, • conserve resources of land and • raw materials • Improve design and construction practice Aware of what CI is doing? Doing enough? • Identifies Sustainable or green ratings systems/initiatives: • Constructing Excellence • CIB *(BREEAM, LEED, ISO 14000, A21, LCA, POLICY/REGS, GOV INCENTIVES ,Landfill Tax and Aggregate Levy)* BIM, Construction 2025 strategy • *Reluctant – why? Risky/barriers mentioned? Lack of client demand* One Sector more important? Responsibility? • Engineering • Architecture • Contractors • *Government* • *Industry* • *Professional/educational bodies* • *The supply chain users – clients etc.* Benefits for industry? Do they think there are any? Costs savings? Greater marketing profile/market advantage, Should they create client/market demand?	

4. What they think would change perceptions towards sustainability		Notes
What do you think would help to change peoples' perceptions of S and for industry to adopt more S practices?	• *Increase training and education opportunities?* • *Inc. in curriculum/CPD?* • *Exemplar projects?* • Sharing of knowledge • Disseminate information • Networking and working together • Learning from peers • Research new ideas • *Raising awareness through campaigns, education and training* Changes required/are necessary to achieve SD/S? *change Perceptions/attitudes in industry?* *Motivators:* **Company ethos** and the commitment of the organisation to more sustainable development • **PR and publicity** gaining a reputation for developing more sustainably may help to promote sales and provide a market advantage, • **Regulation and legislation** developers identified that they are building more sustainable developments because they are required to do so, for example changes in the Building Regulations • **Local authority influence** the local authority requesting or supporting more sustainable development helps motivate developers in order to gain planning permission • **Client demand** Particular drivers that would change perceptions?	

	• Financial incentives/rewards • Building regulations/policy • Client awareness • Client demand • Planning policy • Taxes/levies • Investment • Cost evidence – exemplar projects • Support from local authorities Barriers? - Cost - Policy - Legislation - Lack of client demand	
5. How do you think education can help (in industry)?	• Research useful? • Collaboration between HE's and Industry? HOW? • Feedback important?	**Notes**
Profs Have you previously experienced formal education addressing sustainability and sustainable Development?	Any projects they have worked on?	
Students - Have you participated in any modules which addressed sustainability or sustainable development? Based on what you have learned, how do you think this might help to move the S agenda forward?	Can you give a particular example of a previous module/topic in which sustainable development or sustainability was addressed? Or example of S issues addressed in your modules and how you think provision of such information may help change perceptions of S	

Appendix 7

From: Smith, Charlie
Sent: 26 September 2012 11:21
To: 4048AR; 5048AR; 6048AR; 7005MARCH; 7009MARCH
Cc: Wroot, Ian; Brennan, Michelle
Subject: REQUEST FOR VOLUNTEERS FOR A RESEARCH PROJECT

Hi

Please find below a message from a PhD student who is researching sustainability in the construction industry, and at the design stage in particular. If you are interested in volunteering, and making a valued and valuable contribution to her research, please email Michelle directly by Monday next week. And please remember to include which cohort you are from. Many thanks. Charlie.

M.Brennan@ljmu.ac.uk

Dear Students,

My name is Michelle Brennan, I am PhD student in the School of the Built Environment. I am conducting research into attitudes towards sustainability in the construction industry and am particularly interested in the design sector as the literature indicates that the design stage of construction projects is not only one of the potential largest contributors to environmental impacts but also an integral stage as to where sustainability can be implemented.

The attached Participant Information Sheet sets out what would be required from you if you agree to take part.

Sustainability is a very important topic in the construction industry at the moment and thus this research may potentially help to inform both professional practice and higher education curricula on such issues.

Thank you in anticipation,

Kind regards,

Michelle Brennan

Appendix 8

INFORMATION SHEET FOR PARTICIPANTS

Name of Researcher and School/Faculty

Michelle Brennan, School of the Built Environment, LJMU

You are being invited to take part in a PhD research study. Before you decide it is important that you understand why the research is being done and what it involves. Please take time to read the following information. If there is anything that is not clear or if you would like more information please ask. Take time to decide if you want to take part or not.

1. What is the research study about?

The aim of this study is implement educational interventions over a period of time and assess attitudes towards sustainability in the built environment throughout.

2. Do I have to take part?

Participation in the study is completely voluntary and you are not obliged to take part. If you do take part you will be asked to provide consent. You may withdraw from the study at any time you wish and you do not have to provide a reason.

3. What will happen to me if I take part?

You will be asked to meet to take part in a focus group to discuss the topic of sustainable development. The focus group will last approximately 1 hour. You will be asked a number of questions as a group and to discuss the same. You are not expected to be an expert on the topic, just to bring what if anything you do know about it to the discussion. The discussion will be recorded for the purposes of qualitative analysis. Prior to the focus group proceeding, you will be required to fill in a number of short questionnaires which will take no more than 15 minutes (these can be sent via email if you prefer to complete in your own time).

4. What are the possible disadvantages and risks involved, if any?

There are no disadvantages or risks in taking part.

5. What are the possible benefits of taking part?

Sustainability is becoming a priority for both government and industry and as such the way industry works is changing. Such changes will have financial implications for businesses. Those that have a better understanding of sustainability will therefore be at advantage in the market place.

The outcomes of this study will help to inform sustainability literacy education at both higher education and professional level thus providing for better teaching delivery of such issues.

6. Will my taking part in this study be kept confidential?

All information provided will be kept strictly confidential. You do not have to provide your name on any of the questionnaires and your signature on the consent form can be just your initials if you wish. Signed consent forms will be kept separate from any information you provide. All information will be securely held by the researcher. Any information provided, data collected and electronic recordings will be securely stored and will be destroyed by shredding or electronic deletion after a minimum of 4 years of completing the study.

7. What will happen to the results of the research study?

The results of the research will be used for a PhD dissertation, which may be published in an academic journal. You will not be identified in any report or publication.

8. Has this study been approved by an ethics committee?

This study has gained ethical approval from the Liverpool John Moores Research Ethics Committee (REC)

9. Who should I contact with enquiries about this study?

Any questions that you have about your participation, withdrawal, role in the study or in general, should be addressed to Michelle Brennan, the principal researcher and/or Dr Alison Cotgrave, Principal Supervisor.

Michelle Brennan, School of The Built Environment, Liverpool John Moores University, Henry Cotton Building, 15-21 Webster Street, L3 2ET M.Brennan@ljmu.ac.uk

Dr Alison Cotgrave, Deputy Director of School of the Built Environment, Liverpool John Moores University, A.J.Cotgrave@ljmu.ac.uk

Appendix 9

Dear NAME,

I have been given your contact details from my employer as a potential recruit for my research.

I am a PhD student at Liverpool John Moores University conducting researching on sustainable development in the built environment. I would be grateful if you would consider taking part in my research. Your participation will involve taking part in a focus group to discuss sustainable development. The focus groups will last approximately 1hr however please allow for 2 hours. The focus groups can be held at the LJMU Peter Jost Centre or at a place of your convenience. If you could please indicate your availability and email the principal researcher M.Brennan@ljmu.ac.uk to arrange a convenient date, time and place.

The attached information sheet provides more detailed information and sets out the process and aim of the research.

I look forward to forward to hearing from you.

Kind regards,
Michelle Brennan
PhD Research Student
LJMU

Appendix 10

Focus Group 1 Transcript

M Ok just before we start I'll just explain how the Focus Group works. I've got some sort questions but they're more topic areas that I need to cover but rather than sort of refer to me direct I need you to maybe get a group discussion going and then talk about it amongst yourselves and question each other's views and you know if you don't agree with what somebody says question it and maybe you know put your point of view across and if we just have one person talking at a time so when I listen back to this it makes it easier for me to hear and memorise rather than trying to type two comments at the same time. I think that's it, everything that you say is relevant you know, positive, negative you know don't worry about saying anything, just say it will all go in. I think that's it, is everyone's mobiles off.

I was just going to start by discussing what you understand by sustainability and sustainable development, what your perceptions of it are. What sort of first strings to mind when you hear those words

A: The use of energy but not using fossil fuels, that sort of.

B: Using less energy in what we do cos we still need to create things around us to work, to live

M and what you do, what sort of practices

A: any practice but in the construction industry specifically obviously the energy we use to build and the energy we leave in a building that it uses once we've left

B: using recycled aggregates rather than quarried aggregates so that you're saving digging out further materials from the ground you're just taking what has been used and reusing it rather than that, again sustainable timber, so using FSC is it FSC timber I think where it's from a sustainable plot so for everything that they take down they plant more trees so that there's a sustained growth and it keeps it going through

C: I tend to look at it from more like a three legged stool prospective so I'm not just environmental but also the economic and the social. So here that means what do we do to invest in local communities, employ local people, award local subcontracts. Develop skills, develop people's ability to win work and get jobs in the future

M yeah do any of you sort of incorporate that in to your practice or is it something that you think about when

B: on the North West Construction Hub jobs that I'm working on currently there's a very important KPI that we've got to hit which is localism and we've got to achieve I think between 60 and 70% of local subcontractors and it varies from authority to authority. On my Cheshire West and Chester work it is 30 kilometres from the centre of Chester on my Cheshire East jobs, it's within the Cheshire East boundaries and then you get scored for the subcontractors that you hit within the specific boundary and there's an external boundary where you score slightly less and it's like a sliding scale as you move further out from a particular area and then what we also do is we have on site signing in sheets and we try and get within those subcontractors labour that's local to, and we record how far they're travelling to and from the site and again that's integrated in to a KPI

M yeah to the social side of sustainability, the communities. Anyone else, do you incorporate anything in

D: in my role as Design Manager it's again looking at similar things. You only ever do anything in work if you have to in terms of sustainability unless it saves the company money or anyone money, people will do it and also if they have to do it other than that, if it costs company's people to do certain things budgets are so tight at the moment that they tend to only do what they have to when it becomes, when the economics changes in terms of construction and they're judging people on quality instead of just on costs then it probably has a bigger effect and we can then try to go more for sustainable items because that then gives a better value to the project and the people who are selecting the projects will then get on that rather than just on long term

M and best value overall

D: yeah yeah unfortunately the way it is now people look at the money side obviously straightaway and sustainability will be pushed back in terms of order on importance

M yeah

A: but things like (???) is supposed to change that

D: they are supposed to yeah

A: that's why people are using the construction hub as a vehicle for procurement and not the things that NAME says that, models that we use, structures that we use for social economic styling are just as important, in theory just as important are the commercial side though aren't they

D: yeah well I think the North West Construction office is probably one of the few vehicles where that's happened. If you go to a private client then I don't think they would ever select you over someone else because of the sustainability side of things

C: we're still doing BREAM buildings though aren't we

D: oh yes well BREAM but that's again is something that's required, clients are requesting it because in terms of saving them money later on in terms of their longer term investment in the building and the working costs

D: ok

M is there a lot of client demand at the moment, is it on the increase or will they only

D: I would say that North West Construction is certainly one of the biggest employment, you know biggest group spending money in the local area so it tends to, but obviously that's linked to the government and the government targets from various sustainable challenges

M yeah well more so there's some differences between the public and the private

D: yeah but if, if the private people can see the benefits of certain things like less energy consumption they will push for that because they can see in those terms. But you see quite often buildings are done by developers who then sell them on and so there's a separate link between them and who actually run the building afterwards. They sell them on to pension funds and things like that and obviously slightly cheaper running costs help sell it as well. So they might, they might try and select something that's reasonable to sell on because they want to give it a certain efficiency but if they actually owned it for the next 25 years they may consider that more important

M so it's about the post occupancy as well as the

D: well again that's changing. The number of people sat here sat in meetings yesterday about government soft landings, which is about how the design and construction stage will stay longer involved and there will be three post occupancy assessments to see how the original design works against the actual. And one of the questions is if the models don't work so it's becoming more essential

M yeah how do you think that's going to impact on your work then, the government's soft landings in terms of when you design?

D: oh it will have a big effect the whole model will have to be understood better. So they will be talking about creating electronic models of the buildings and assessing them for occupancy and how it works but it will mean that the clients will have to understand more about how it works as well because if they just come to the table with we want an office building for 250 people they'll have to know more about well what times is the occupancy going to happen, is it all between eight hours or is it twelve hours in a day, do people come and go at the same time, will the door be opened constantly for half an hour in the morning the heat loss would then have to be calculated. It would be quite a complex change. Whereas at the moment that doesn't happen

A: it's a significant risk for us in business because it means that our responsibilities to the building stays not just for the twelve months with the defects and the infrastructure, the concrete and everything like that, the actual energy use will be measured in a few years' time the overall energy use of a building. What we thought it was going to use and what it actually does use at some point if it doesn't do what we say it was going to we will be at risk to put it right whereas we didn't have those responsibilities before, so it's quite significant for construction companies

M yeah. How on board with it do you think they are, are they ready for it or

B: I'd say commercially it's a big risk at the minute and its, you'd have to look at it, if you came at it from a purely commercial aspect you'd have to price in well what if that fails or what if the heating isn't up to spec in twelve months and it's a lot of what ifs and you're trying to in essence pick an item off a shelf from the air and guess that it might fail and that that it might fail you'll have to price that in which will then, if something was worth £10 million it might be on the tender £15 million because you've got to price in

A: the risk

B: the risk of if the heating goes and you've got a five storey building well how much is it going to cost to rip out the heating and put in a, an on spec new heating system that hits the regulations that you need because that doesn't quite hit what it should be hitting on the model so it brings in a whole new aspect in to how you approach the tender, how you approach the build and then the end cost to the client. And I think that then pushing the initial on outlay for the client at the beginning of the project or having to keep a significant portion to one side for that project would scare most clients off from that particular avenue of building new offices and building of the like

M sustainability

B: yeah

M sustainably you mean yeah so it costs a huge factor

A: yeah well its risk but there's a cost associated to it

D: the other thing I think is actually selecting materials, you know you talk about the idea of the FSC timber is an obvious way to see how that's rated but there are so many materials in the building that you can ring up and ask a supplier you know where the brick is from and it might be stored in their yard here up in you know but created

somewhere else and transported up so it's trying to find out where the origins of some of the materials have actually come from and then putting that against cost and locality and things like that so that what I was saying, if there was some sort of matrix that you could give a scoring to understand how far its travelled. Cos you talk, you talk about carbon rating and all this sort of thing, we don't actually know how much energy's gone in to making that product and it's very difficult to compare the manufacture of a small brick to a steel work

M so again the embodied energy in the building from you know

D: yeah and that's very difficult to understand when you are trying to put together a building in a very short period of time and select materials over what it looks like and then try and source it. So it's not an easy thing to do

Obs: now is that information becoming more available from manufacturers or suppliers or is that something that you're still seeing as a bit of a gap at the moment

D: it's one of those little bits of writing that the bottom on one of the pages, it's not something that they try and sell because if you've got a national company that only builds it in one area of Cornwall for example they're not going to announce that if you are trying to get all of your materials within a 50 mile radius of the job

B: what you've also got as well is a lot of architects and consultancies have ties or not necessarily specific ties but they'll use or prefer certain manufacturers. So what they'll do is when they've drawn their specifications together they'll take specific types of brick because oh well I've used that previously and that, I like that colour and I like the way that looks and not necessarily consider well is it from Dover or is it from wherever or is it from Exeter. They don't consider if it's from down south, up north, on the west coast, the east coast, it's I like the look of that, it looks aesthetically pleasing

M from a design perspective

B: yeah. So I want that material. And the impact from where it's coming from doesn't come in from the picture. Erm so if you was to try and steer the industry in to a completely sustainable build then its, you've got to try and in my eyes change the views of the consultants as well as us building it because they drive, they drive the initial design and if you want a truly sustainable building then a lot of legwork for me has to be done before those tender documents even hit us as a construction company because you know you could talk about insulation , EGWP0 and making sure that and

there's loads of little pockets of information that would lead to a more sustainable build but at the minute all that legwork although its done in part isn't done as an import, right it's not high on the importance list, it's more a case of does it look aesthetically pleasing to the project and then that's where it moves through

D: you've got to remember that the client is looking for their end building. They're to be honest not really interested in all the bits about the construction and design, they just generally want it fast cos that's when their money, they've laid out all this money and they've got to start earning off it to put buildings up like this and fill them up. And so they just want it done fast and so the time that it takes to do all this is very difficult to build in to the normal building programmes

M yeah

D: so people tend to as you say use, and we do the same here don't we

A: Yeah

D: we use companies that we've worked with before that have given a good service and we expect them to again rather than exploring maybe some other local labour

M how do you think you would go about changing that, getting industry to view it differently and you know change the mind-set of not going with what they know but taking that risk and moving forward

D: have you done a study of how the industry's changed over the last thirty, forty years

M sorry

D: the industry generally, the construction industry's changed massively in the last forty years from a traditional based architect who would do all the information beforehand, issue out a ill of quantities and lots of different contractors would then do that. My first job was eight of us working in an architectural office, working on a scheme that was for £1 million the Liverpool School of Architecture extension. And it took 18 months for a team of eight of us to hand draw everything. Do the bills of quantities, details and that then went out and I think it was then 4 months for the contractors to price that up. That job now would be expected to be done by one or two people in probably 16 weeks

M is that because of the technology that they've now got

D: no cos its technology only draws it for you, it doesn't design for you, it just adds more information. It does help certainly because you know the old drawings you had to

scratch off and redo to the plan but it's still a question of time. The whole of the project then for £1 million took 18 months on site. That now I would say we'd be looking at 28, 26 weeks to get done so the whole process from the start of design, from client to getting completed building was probably 25 to 30% the time you had 30 years ago

B: you're catching two things though aren't you, you're catching the architect who gets the preferred supply chain partner say

D: yeah

B: to do part of design work so he doesn't have to spend as much fee doing it, he can do it quicker

D: yeah

B: technology does make a massive difference. Email and things like that

D: yeah

B: go back to faxes and it's not quite the same or letters you know, you used to write people letters and expect a reply when we had a query so. The technology, that relation of speed is. Sub-contractors of solutions to build is based on who does the most to help to get the architect along

D: yeah

B: and to answer your question I don't think they would tender, they'd use, they'd carry on using whatever is best for them to help them move along

D: the only way I see it will change is if it becomes a requirement

M legislation

D: yeah

C: well theoretically with Building Information Modelling and I'm going back to what you were saying about the availability of the information. At the moment it's, so for example of Centre Parks we were looking through materials trying to understand how much recycled content there were in the materials that had been specified. All the materials were supposed to come out of the green book but that doesn't account for recycled content. Theoretically if you are using Building Information model where each component has a shed load of information against it including how much carbon there is in it, where you buy it, how much you buy it for

D: how much energy goes in to making it

C: embodied energy goes in to making it that would help you make more informed decisions

A: it would but on a lot of the hub jobs at the minute that are coming through where we are at the minute on the sort of small work side is we're getting about six, six to eight weeks maximum to get drawings made, specification made, price, backing, sent back to the client and then on site. The period that you need to get a fully sustainable design on that just isn't there at the minute on the hub because its, the school say right, the schools that I've been working on got right ok well we want, it's now October, we want a three classroom extension to be ready for next September so there you go, that's the brief. Then it's a case of quickly get it designed, get it in for planning, get it priced and then you're on site in February so you're up against the wall as it were to get the building out, to get it agreed with the client, to get it sorted and like you say the sustainable section or thought processes sort of get pushed towards the back because it's more a case of drive the design, get the client what they want and get them in for that time. Because if we don't deliver the time then we won't get the next job and we won't get the next job and we won't get the next job and then we just won't be able to keep the business running if we don't hit what the client needs. So it's probably, you'd need to try and change the thought processes of the clients and maybe you know your councils, your private builders so that they understand what it is to be sustainable so that then the periods that follow on from then are more in tuned to getting the buildings sustainable and across and how that that protect the environment as well as getting the client what they want

M yeah

E: that's a fair point that, it is down to only having enough time to do it once isn't it perhaps the only way you could do it is some form of legislation that says for every, you know after tender three bids and packages, well maybe you have to do three designs or you have to do something like that that you can then fully assess to say well actually that's the quickest, that's the longest, that's the cheapest and actually that's the most environmentally sustainable, that's the one we're going for

B: I think it is slowly changing in terms of education cos I've just been offered, just going in to the fourth year of a construction management course now and I've just been offered two different modules. One of them was off site prefabrication just because

the course I'm anticipating change from traditional buildings to more off site stuff where everything's prefabricated with a lot more tolerances so less waste and obviously less carbon and that sort of thing so I think everyone is recognising that its coming round it's just probably slower than what it needs to be but whether that changes I'm not too sure

M why do you think it is though, is it because the clients aren't asking for it in the time and cost restraints?

B: I think people will do it to try and save money. For example if you bought solar panels on a house it will give you a return in 25 years but if you're paying £10,000 up front you might not be prepared to make that initial outlay and wait 25 years for the return on it

D: that's that idea about the developer building a building to sell on to a pension fund, he'll be looking at the immediate return rather than the long term

B: especially a company in this sort of climate where there's no profit and everyone's struggling, they can't wait 25 years to make any money, they have to make it now or bust really so

C: I thought what you said about listening before was interesting in that it kind of made me think that each separate in the process of like the decision to build, the business case, the design, the construction it's always a series of trade-offs location, localism, how much money you've got available, environmental considerations and that people have different priorities and so that constantly the trade-offs you know it's not the same on every project that you'd say well I'd always pick environmentalism above everything else because it's a constantly moving feast if you like. And what's important to one person at one time will be different to the same person at different, same person at different time depending on all of those considerations

B: but coming from a commercial side and dealing with the hub I'd disagree with that completely because at the minute we're putting a, we're putting in a bid, in bids and the client does their own budget and our bids are between 10 and 20% above and it's the clients perception of well I believe it's worth this when actually they don't really know what the value of the project is. We come in with a figures, 10, 20. 30% above where they believe the value is and they go no it's too expensive we need it cheaper. And to get it on site and get the project going you need to bring the cost down and to

bring the cost down you look at ways. And is like well ok well that material's cheaper, that material's cheaper, that material's cheaper not and you don't look at the sustainability of the material you just look at the cost of the material to bring that price down so that the client's happy at saying there you go there's the there's the there's the contract please go and build it for me

C: yeah no I agree with you so there's always time cost, there's considerations and that for your clients at this moment in time they're much higher priority than environmental considerations

B: I think a lot of the cost savings things are subconscious, for example if we was to take a look at waste to landfill now we would know it would cost X amount of £'s but if we're prepared to recycle the waste we're doing that as a, we're saving money on that but is also subconscious thing that kind of slips in for example if you said to somebody 25 years ago you'll have four bins in your back garden and you'll be recycling paper in one and glass in the other they'd look at you like you was mad but it's just kind of slipped in under the radar and nobody's noticed its happened but is has and I think it's the same

F: my kids automatically sort things out like that whereas certainly mum and dad's generation it's not even considered

B: I think there's a different perception in age groups as well like the older generation are more traditional brick and block and different sort of construction technologies will have a different view to someone fresh out of uni or fresh out of college or whatever it is they do

M as a student are you learning about sustainability on your course

B: yeah but again it's kind of filtered across the board rather than say for example one specific module

M yeah

B: it's kind of filtered in to everything

M I'm just wondering now your graduates so you know when you come and work in to a company and you know you know all this knowledge about sustainability but they don't how you think cos from what I've research industry is very resistant in a certain mind-set and it's an intergenerational thing what you've just brought up then so say

graduates coming in to industry and maybe trying to change it to be more sustainable do you think

B: I think it depends on what you come in to for example if I don't think I'd be able to have much of an influence because I'm not the architect, I'm not specifying what's been used. If it was a design and build job you might look at the job and say oh you could use that, save money, its more sustainable but you wouldn't necessarily pick the materials or decide what you was actually using you just have an overall influence on how it was built and that sort of. I think it needs a bit more from the designers and the actual people that are building than actually designing the building rather than the people who are doing the operational side of the building

M right ok. So design sustainable practices in to it and factor out waste etc. You think it's a design responsibility

B: well it's probably across the board but it also, I wouldn't expect somebody say a site manager for example to do that. It would be more the designers and the project manager or whoever it is that's looking at the job in the first place to say that might be £10,000 more expensive but in the long run we might save £20,000 out of it. But again that's, I think it depends on what, how long the duration of the job is and how long you're involved cos if you're only involved for 12 months you're not going to be as a contractor interested what the end user saves in 25 years because it's not your, it's not your remit to decide that if they've not specified that you're not going to necessarily say you can save £20,000 now but if you pay is £10,000 extra because it just looks like we're trying to make more money out of it

D: that is what government Soft Landings is about

A: I was about to say the same thing yeah, that's what it's about

D: the government are bringing in these recommendations on how you've got to argue about what you put in to the building now, what it might save over the in 25 years or so

A: right

D: they've put an argument together that for each £1 that you spend on construction now it costs £5 to maintain and manage and manage that building, but it costs £200 for every person that's working in that building so you know if it cost £1 million to

build it would be £200 million pounds to cover the cost of people working in there and £5 million to cover the maintenance

A: Umm

D: so if you put something in now that's £20,000 more you could be saving £40, 50, 60 thousand out of the £5 million budget that it would cost to run it

A: yeah

D: so that's what they want to see that argument but it's going to be quite. It means the model, the BIM model will have to be more and more accurate and the understanding of how it's used with will be more important. And there you can start to then show there's savings on energy or replacement of materials on a floor for example over the 25, 30 years

E: and that means better integration with Facilities Managers and end users during, during the design process and through the construction process as well

D: I've talked about having people who are in Facilities Management now being involved at an earlier stage to say well you know this type of carpet wears out after two years whereas we've got one in there that's lasted 20, can't we have a look at that. It might be twice as much but if it lasts five times as long then its better value

E: yeah

D: so the construction costs may actually go up initially but to give a better value in the longer term

OBS: have you seen any movement from clients towards that kind of whole life cost approach

D: it was involved in the PFI to some extent cos PFI had a separate funding stream which they continued to look after it so the FM people got involved with the construction at an earlier stage and it did yeah it had one or two influences on material finishes and the way the buildings operated probably went up more because it became a lot more mechanically controlled in terms of if schools didn't open the windows they were opened by a machine because they said it was too hot. And that could be controlled from anywhere in the UK. So you'd have someone sat at a central control which had like 50 schools to look after. And they could see from their screens what was going on in all the schools at any one time and they picked up if it was overheating or it was short of oxygen and they would open the windows automatically. That was fine for

controlling energy and everything else, the schools hated it because they couldn't work out if they could open a window if they were hot

E: no, no control

D: yeah and they didn't like losing that control so people now want to go back to just opening windows, let the energy out, they don't turn the heating down, they just open the windows cos they're too hot

B: yeah. I know it might be slightly going off topic but if that's the way everyone is being forced to go where you're going in to the same sort of PFI route where you're maintaining the building in that sort of situation will that not just give the likes of COMPANY NAME and everyone a chance to run riot and win every job that's

D: yeah well that's a, I think PFI is going again, fairly limited again but that's how it was 14 years ago and you know their PFI route is costing a fortune to keep the buildings because of the rates were so high

B: because a company like us that when we're doing the traditional 12 month defects we're not going to be able to convince a client that we can do something for 25 years when we've not done it were the likes of COMPANY NAME have been doing PFI jobs for years and years and maintaining hospitals and that sort of

D: if you speak to any of them I don't think they'd want them again

B: I think that business needs to understand how they've managed, again going back to that risk again though doesn't it. Answering your question again though I think in the last, you might be able to correct me in the time that you've been here but I've only seen, certainly in the last year or two one question on a bid that's been relating to lifecycle costing

E: right

B: maybe two. So even through the construction hub jobs it's not a regular question yet

E: no

B: but there are, we have done one or two private sector tenders where the client has said you know what are you doing about lifecycle costing in your design process

E: right

B: because they're going to be the owner operator of that building

B: because they obviously knew that was coming yeah

E: yeah

B: but it will start to be more of a significant question I think in the future the model they are

D: but it won't be because if they want a green building or anything they will want it because it's cheaper to run

B: yeah

D: and that's the driver

E: again it comes back to cost from their point of view and behaviour from your point of view is driven by the client's requirements

B: yeah

E: yeah ok

B: it goes back to the costs thing again doesn't it, they're actually changing direction from cost up front to cost to run at the end, it still might not be the most sustainable. It might be an element of the most sustainable construction methodology but are we now moving it to is the be all and end all of what it costs to run it

M yeah

B: that's probably where it is but there's still an offset to

A: it's going to be a happy medium of both isn't it. You've got to, the initial outlay married with the facilities management of it

B: ok

A: and there's going to have to be probably be a model driven that says well on initial outlay if you spend loads and loads and loads up to a point how does that affect the running costs and is there a point where the balance tips where no matter how much you spend early doors it's not really going to affect how much the building costs to maintain and run

B: yes you're right

A: upon completion of the construction

B: yeah but that might not be necessarily the best thing with digging out the ground

A: no

B: you know that's the other, maybe the three stool thing you know it's the same point on the score but the other thing could be the most, best cost-effective method of it might be using brick that we have to mine from Cheshire somewhere that actually isn't the best for the world or oil from fracking or something like that that's not

actually the best thing for the planet but it's the most cost-effective for someone who's running a building for 25 years

A: and over those 25 years the carbon footprint would be less even though the initial

B: but how do you measure the carbon footprint of digging up the planet

D: which comes back to my scoring method

A: it does

Obs: I wouldn't have a clue how to start that

A: it's a minefield

D: and you'll find manufacturers will come in and they'll tell you about their green ecology best thing ever but they'll be something in there that probably completely counter products that argument and you're just not aware of it

E: yeah it's kind of selective information

D: it is

E: I had a meeting this morning with a guy who is doing asset inspection and a great company whose sustainability record looks fantastic but from inside the facility their performance is absolutely dreadful. So it's what you, it's the information that's out there, what people tell you is different from what actually happens

B: yeah

OBS: and I think it's really interesting that you're saying that is one is access to information

G: is there any point in me coming in now or not

C: what time is it?

A: we're well over

C: I think you might be let off the hook

E: it's having one, going back to the point we made before about having access to that information and being able to put your hands on the data that we talked about but also there's a trust element and I think you know you kind of touched on it with what you were saying as well. Can you trust the information that you're given and be able to make that balanced view in order to say we have chosen or we have made a selection on the basis of the most sustainable option available to us?

D: yeah

M yeah. Where does your information about sustainability and sustainable development come from then, just government legislation, regulations that come in or from what

clients tell you ISG has come out. I know you're the same sustainability manager but do you provide training packages and

D: what, what are we training for in terms of sustainability. Is it

M on how they can be embedded in projects and maybe how to inform clients. Do you get anything about sustainability in the company or is it just what you learn that drifts in from government

D: I would say a lot of it is you're required to do lots of things and you try and do the best in that. BREEAM is probably a good example. Well BREEAM I would say it's not a simple process again and people just pick up points which are the easiest and I will quite often hear hitting the first like 60/70 marks is relatively easy but to pick up going from a good to excellent you're looking at £20,000, £30,000 per point it costs to pick that up and people don't want to pay when it gets to a certain because you just hit the point and you're not benefitting the building greatly, so that's you know you try, but if it comes at a cost which is just to get the points it doesn't benefit, what, why should you do it. So that's quite difficult to understand

E: yes unless it's specified and paid for and some clients may well go that extra mile to try and achieve a certain standards to be able to go out in to the wild world and say look at our BREEAM outstanding building

D: yeah

E: but otherwise it's not just going to happen for the sake of it

D: no unless, unless someone pays for it, it won't happen will it. And that, that's a difficult one to do

B: like you've just mentioned as well about somebody offering a building saying its BREEAM outstanding again it relates back to cost because people using the building won't have to spend as much to run it so they're obviously prepared to take the initial outlay to sell the floor in the office or whatever it may be that they might have struggled with in the first place so

A: to go back to the point you were saying on training for me, I've been in the industry now for about ten or twelve years and there's no, there's been no formal full proper sustainability training is sort of been pay to pay knowledge passed on, oh you've got a BREEAM job. Oh have you used GWP0 insulation. Have you used FSC timber? Whilst you're building the job have you had a shower? Have you had rainwater collection?

Have you had solar panels and its more pay to pay whilst you're working on a project and then you take that knowledge on to your next job with you and then if somebody else on your next project doesn't know then you pass that knowledge on to them and the likes of the design managers who have had experience in other facets of the industry coming in to the company bringing their knowledge from outside in. That's really how the knowledge gets conveyed, there's no in my eyes specific sustainability right you need to go on this sustainability course to look at cost, you need to do this to go and look at social and so on and so forth. It's more as I said pay to pay oh you need to do this or you need to think about that. And that's sort of how it's happened with myself

M is that the same for all of you or

D: if there was a sustainability under building regs that you had to achieve you would then be able to mark yourself down and against that and it would be targeted a lot easier.

E: yeah

D: the fact is it's embedded in little bits and pieces in terms of energy management you know

E: I suppose the closest you've got and you mentioned there is probably part L

D: yeah

E: but that's very much kind of designing to a standard

B: it's complying with

E: it is its complying with building regs say that's what you're U value has got to be for that particular element

D: you can swap it around a bit

E: yeah

D: but it doesn't say how you do it

E: no it doesn't, no it doesn't so in one respect its quite, it's a good piece of regulation in that it allows the market to decide the best and most efficient way of doing it

D: yeah

E: which I think from your point of view Michelle means there isn't a prescriptive way to be able to roll out to the industry to be able to say, all you can do,

M yeah

E: all you can do is set the outcomes and let the industry decide what's the best way to achieve that outcome

M it's so fragmented and so many different players isn't there, when you're all doing separate jobs it's hard to have one document for all say

C: we have done environmental awareness training at Centre Parks but that was quite specific to meeting the needs of that projects

M yeah

C: and only the environmental bit not the whole sustainable agenda

E: sorry go on

A: I was going to say you've got British standards for almost everything within the industry you know perhaps the vehicle might be is there a British standard for sustainability of a building. And if there's a, like you were saying before specific guidance of to be sustainable you need to be X,Y and Z then when you are putting a building design together you've got that X,Y and Z to incorporate in to the design and then everybody's playing on an even field. And you know you might have a fully sustainable company here but these might be just looking at costs. But if you send the tender out and say this is the document you need to price and it is these standards and there is a standard for sustainability in there then everybody will be pricing the same thing and you'll have a true representation across the board in every tender as to what, what's required

C: there's a British standard for sustainable procurements but we don't tend to use it

H: I know

B: because of costs

H: I don't know

A: the client doesn't request it

C: it tends to, the companies that have it tend to be materials

B: which are

C: materials

A: like Hansons concrete

C: yeah

A: aggregates and things like that

B: well then what you could do is put a British standard on a product and like the green guide you could specify at the start that we're only going to use green guide rated triple A or A plus products on this job. There you go and then everyone has to do the same then every single product that goes

A: sustainable

B: sustainable that an option then

E: that happened on COMPANY NAME, well it was supposed to happen on COMPANY NAME

B: what was?

E: that using the green guide highly rated materials and they, COMPANY NAME had this grand sustainability strategy and I went and did the training on site with the guys and the approach was fragmented to say the least. It wasn't

D: is that because you couldn't get all the products that were rated like that or

E: nobody was driving it as far as I could see from the client's point of view. So they had this strategy saying this is what we want to do and COMPANY NAME were awarded the contract to build the chalets and it just, it's not I don't think it's no criticism of COMPANY NAME but it's just not been driven down the supply chain. There were some good things happening from when we did the course and lots of people kind of turned around and said oh yeah we're using 10% recycled content in these plastic drain covers but it wasn't driven by anything coming down from the client. And that project was very much driven by very strict time deadline wasn't it

C: well for all we know everything that was specified was in the green guide but I think the information never made the leap from the designers

E: yeah

C: to us doing the construction

E: yeah

C: and then when we were trying to backtrack to understand you know what was being used in the supply chain, yeah we certainly weren't linking driving that down

M so there was a lack of communication

C: yeah

D: it's traditional that you seem to have a gap between certain stages as it gets passed on and again this was all in the meeting yesterday wasn't it that part

M you think there should be greater collaboration between the parties then, a better sort of

D: well they're talking about BIM – which is Building Information Modelling

M everything's out there for you

D: and on that it records all the information so that when that starts to come in from the manufacturers and it has the, all the guidance on it, it will be attached to the model that goes through will it so anyone can interrogate the model and understand maybe why certain things were selected

M do you think private clients or people who procure private jobs will use that as much as public because it's something that the government's mandating but it's for all public projects isn't it

D: I think it will probably follow that everyone will end up using BIM for every model

B: it's a government project at the minute but it will be manager won't it sooner or later

D: I just think

B: you did say, you did say didn't you

F: 2015

B: yeah 16 something like that so yeah it'll become a. Probably what we were just talking about the courses whose going to manage it so yeah it will become managing

M for everybody

B: for everybody yeah

D: I've been involved in a project which has all the three main trades of mechanical, electrical and structural and architectural working on one model with clash detection, worked brilliantly. If by choice I would keep working like that constantly and I think once people are trained because there's probably only 5% of architectural staff out there who are probably capable of working with BIM, so once that builds up to 50/60 and then all the youngsters coming out of college will have that skill, it will change

B: well it will…won't it

D: wish I had done,

A: I think it's like anything, I think a lot of people are scared of doing things aren't they cos it's not something that they're used to. Whereas if you've got 30 years' experience of doing something and you're told overnight you've got to learn something else haven't you. People aren't going to be prepared to spend another two or three years

D: well we've done it this way for years why do we have to change

M how do you think we can change that mind-set? That's sort of the crux of this

F: bringing in new blood

A: well I think the old guard will stay as the old guard always. And they'll always know best irrespective of whether you can prove them right if they're wrong they'll consider themselves to be right. And you'll, you're fighting an uphill struggle to convince

D: there was one person sat in that 120 architects office that had a drawing board, the other 119 had computers and he just wouldn't entertain

B: the way forward is getting people like NAME or people who are on education courses taught or built environment courses, construction courses, taught about things like BIM. It's got to be the only way hasn't it. Come out so they can sit at a computer and open up the relevant page and put the information in, take the information out and understand what it means

D: it will happen. AUTOCAD exactly the same effect. I started on AUTOCAD in '87 and there was 5 people in the office and 60 that had it within 5 years there was only two people that didn't, so it did change. And once they can see the benefit people will move to it but it does, there is an inertia for people to move forward

A: I think if it was proven people, and there was some sort of incentive that the older people that are already involved in it then it might be something they'd look at but if there was no sort of incentive and you've still got the same outcome at the end of the projects why would they change them when they already know what they are doing and it works. But if it as Nick was saying, if it's something you're taught as you coming through that would be something that you know but at whatever stage you're going to be I could be sat here in forty years' time and say you know BIMs out of date and I'd be saying oh no its not its good but somebody's trying to change my perception of the situation

M yes

A: is

M always changing. At the minute then, it brings me on to some of the last topic I need to cover that how do you think education can help industry. I know we've got sort of new graduates coming in but how do you think education can help, maybe come into industry from my prospective designing this model to sort of pilot with the students

and then I'm going to try and bring it in to industry, I don't know what it is yet, this is why I've got all you guys together to try and inform what I do

D: what how sustainability issues

M yeah. Or just sort of change their mind-set and come in with sort of a model that tries to educate industry on sustainability

B: you could probably so it in schools, and you'd have to do it as early as possible really but again its doing it in schools you'd have to justify to, you'd be like creating a new lesson, you'd have to justify the cost of it all but if you filtered it in to slowly just kind of again filtered it in so it's not a standalone module type thing. But I thought, I think if you try as I say you've got to go and do an hour a week on sustainability, you'd have to obviously justify that to people otherwise they say why but if you filtered it across the board over different courses and different sort of lessons you might get away with it more that way

M do you think building it in to CPD would work then do you think

D: no I was going to say are we talking about sustainability across the board or are we talking about it in the built environment

M the built environment

D: so it would be students

M itself yeah

D: so students within the university all learning the course on building is obviously the first to look at isn't it

M yeah well they're all getting that education but industry's not you see

D: yeah

M so they're graduates are coming in and coming in to a very resistant mind-set you know it's the intergenerational thing

D: no I think it's down to whether they're, industry have to do

M so you don't think education can help industry

D: it will certainly help but even if you taught everyone about sustainability it's like I don't know, going shopping in the high street you can have a plastic bag to carry you stuff and you can have a big cardboard one, it's a shop's choice to try and sell their products isn't it, it's how the construction industry says to do things. No it's how you sell the construction as a whole, they'll be architects who push the green and sustainability

then there'll be clients who are prepared to pay for it. Once those buildings start to get accepted and they're not seen as being more expensive then it will be acceptable to keep moving in that direction I think

M yeah

D: but it will all be about the

C: I think the important point is that it's not just about educating the kind of the construction management students, it doesn't matter how green James is if the business, if this business is run along the lines that meets clients requirements and clients don't demand it

M is that the bottom line

E: I think if you ask the industry generally they would say if we were asked to do it we would do it and the industry would respond, the industry is responsible

D: they respond to what he client wants

E: yeah

D: that's, and if you give, and if you give them more for the same price then they'll be quite happy to take it but most companies can't really do that. So we'll try and be green as much as we can but if it starts to cost more money and that goes to the client then the clients says well we're going down the road its cheaper down there. And that's the same with all of the trades involved in putting a building together

C: so for me it's about educating everybody

D: yeah

C: whether they're training to be, you know school teachers or caterers or economists or you know so that everybody's behaviour changes including client behaviour

B: that's what I was trying to say about

C: not just changing our behaviour

B: getting it a right school sort of level to it becomes natural then and whatever sort of job you go in to cos you won't just get it in construction, you'd have to get it across everything to make a real sort of difference because, it just wouldn't work doing it in construction alone I don't think

M Ok

C: so a big remit for you

M I know, change the whole world

C: crack on

A: today the construction industry tomorrow the world

M yeah it's a valid point what I'm just trying to sort of see where I can go with my PhD with this and maybe what it is that I can come in to industry and do. You know should there be more collaboration between industry and university as you think so we can impart our knowledge what the students are getting

D: we get CPD seminars from manufacturers who sell their strengths. It's very rare that you get someone coming out who's completely independent, who can try and identify what those strengths and weaknesses are amongst the products out there. Ultimately I don't, if there was two products the same price, one offers

M it's going to be

D: you know a green solution, there would probably be the option to take that but until it comes down to anything else I think it will mostly be cost driven

M cost and the legislation

D: legislation is absolutely the key one and the idea of this North West Construction Hub wanting people and suppliers from the local areas is certainly having an influence in terms of that end

M the social element

D: yeah

M how sort of, I'll scoot back to the first point, are you aware of the social, economic and environment, obviously the environmental is probably more but the economic and the social dimensions of sustainability

A: on that again something we said earlier was on, on the sites we're trying to drive local labour as well as local sub-contractors within 30 kilometres, and you try and get the local labour. Whenever we go to and get a labourer for general site clearing we try and get a labourer that's local to the area that fits the needs of the business. We also are trying to, where we can, is in some of the prestart meeting minutes on meetings that I've had of asking the various sub-contractors do they have any apprentices on their books. If so can you bring those apprentices on to the project so again it's that social aspect of giving the younger generation somewhere to learn and somewhere to apply their trade that they can go.

M yeah

A: and be an electrician, a plumber, a joiner, a bricklayer

M do any of you find that on your projects or

B: well the times I've had on all of them, it again it's ticking

M boxes

B: yeah unfortunate phrase but it's to tick a box because it's a requirement. But that's where probably the education opportunity to come is that we've to up skill young people so that they are aware you know the young male electricians are coming through the young bricklayers and plasterers that they understand where the materials comes from, the type of material it is things like that at an early age

M do you think there are any other barriers apart from cost and, that prevents industry adopting sustainable practices, is it just cost and client demand

B: I think they're probably the main two

D: generators aren't they

M yeah. But do you think there's any incentives that would maybe help industry to offer a sustainable apart from legislation you know, course yeah. Any other incentives that you think may help. Rewards rather than penalisation

A: what rewards sort of like government grants so maybe if you hit certain sustainable targets you get a certain figure back as a rebate from the government for creating a sustainable built building. Its I don't know, I'm just

M yeah. How do you think that would drive forward client demand?

D: in a. Sorry, going back in a way I suppose the idea of bringing on apprentices is ticking the boxes so you get the opportunity to bid on your next lot of work because that adds value to your next bid. So I suppose that in a way is the incentive to make sure you hit certain targets because you then get the opportunity with the next

B: do you do that though

D: no, no but that's what. That's the only thing I can think. I mean unless you start getting financial return for doing certain things

B: no, no, it's not necessarily a financial incentive is it, it's a financial disincentive if you don't do it that's you know

D: yeah

B: you won't get work so it's easier to say yeah you know for every apprentice we take on is £500 oh right yeah great but it won't work like that and if it's the other way

around and you don't take apprentices on then you lose the whole. And then the greater financial incentive to us to lose something like the hub would be significant so

A: I know it's still an indirect relation to cost but if for example contractors are trying to get experience of working in that sort of thing say when a job comes up say in ten years' time that could be like £100 million specialist sustainable development project, if the contractor doesn't get in the working bits and bobs here and there I know it's still trying to win the work but if they've got that experience it's still a bit of an incentive to do that sort of thing

M yeah

A: I suppose it's if people are willing to do it for the cost

M just one last question. Who do you think should drive forward sustainability, government or industry or both? Who do you think more?

D: the most influence would put the government

A: I think the industry's probably got a bit to do with it because I think construction's like the worst industry for carbon and its, I know it's been like heavily attacked, well not attacked but probably sort of

B: criticised

A: criticised that's the word for it

M yeah

A: and I think construction's probably had the biggest like targets set for it by government so obviously it's the government to implement the control but contractors and designers have got to do something to try and meet the targets that they've set so

M do you all agree with that or

B: government's got the strongest power hasn't it but the private sector I guess has got to follow to keep up with that haven't they. Way that the construction industry can beat it or not, I'm not sure

A: I think now the construction industry generally takes its lead from legislation doesn't it and it doesn't change unless legislation changes and to drive sustainability you're going to have to drive sustainability legislation to force the industry to change because yeah the industry will change but it might change over five, ten, fifteen years. If legislations brought in its going to have to change in five years and there'll be a specific

deadline you must change by, bang that date otherwise it will be a case of oh well we'll try and meet

D: lip service won't it

A: yeah. We'll say you know we'll try and meet what you want and we'll get in to the project site and say yeah but we can't quite do it that way so we've got to do it this way which isn't a sustainable way of doing it because and there'll be a million and one excuses as to why it can't be sustainable as the guidance says if there's specific legislation you will do it Bang, then if you don't hit it then you've got nowhere to go, it's like right ok well if I don't hit it do I get penalised, does this happen, does that happen. But until that's sort of like battened down the industry will just sweep along and gradually take in the change but nothing hard and fast will be sorted I don't think until its done

B: I suppose the only other thing you could do is if, if you were in the same position now in ten years' time having had ten years' worth of schooling, of education you might not even think twice about using the none sustainable products. Going back to the point you know when you did it nearly thirty years no one even think. You know the choices of sustainable products might not be a non-sustainable product full stop but actually your mind always says well I'm not really bothered about cost I'm just going to go with that one

A: going back to the legislation thing is, it might be a bit of a cheesy analogy but if you're driving it might be safer to drive at ten miles an hour but the speed limit's thirty miles an hour so unless they change it down to ten miles an hour you're not going to do it are you

M yeah true

E: you're asking now

B: my car won't go that slow

A: I've only got a 1.2

M I think that wraps it up then thank you. It was very informative thank you

B: no problem

D: so you've just got to go off now and figure out this big spreadsheet

A: this model, yeah, yeah you've just got to create a model now

B: so where does your drive behind all this come from, what's your driver behind it?

M doing my PhD do you mean

B: yeah your subject and what brought you to this subject

M Well I did psychology so that's where they brought me in to try and get what we know from psychology to change the attitudes in industry so I've looked at emotional intelligence and I developed a questionnaire to measure attitudes towards sustainable developments because we didn't have a questionnaire that quantifies it so then I could measure it against emotional intelligence and see if there's a relationship between the two. So those I've found to a higher emotional intelligence have more positive attitudes towards sustainable development. So maybe it's more sort of being emotionally attached to the environment or sort of differing factors that I'm starting to look at now

B: what do you mean by emotional intelligence?

M it's sort of how aware of your emotions you are and those of others and how you're able to sort of manage and facilitate them in environments like this but you do it subconsciously

B: right

M so it's sort of big in the leadership literature as well you know being able to manage people and

B: so not necessarily educational intelligence

M well it's huge in education because they've found that emotionally intelligent students do better academically and with their peers over and above general IQ. If you've got, cos especially in university if you've got a higher emotional intelligence you're more likely to engage with other students and that makes you stay at university longer than more so than drop out and emotional, it's becoming a big thing across the board so I'm trying to tie it in with sustainable development now yeah. But it's not really been used before so it's all new so I'm just sort of now yeah finding where it sits sort of thing and can we use it in maybe training packages

B: right, have you actually looked

M yeah

B: so have you actually looked at the amount of education content in perhaps, I don't know junior, senior school whatever. Is there any sustainable education going on, is there looking for that development like

M yeah well I haven't done that but my supervisor and another PhD student they integrated a curriculum model in to John Moores University and they sort of researched it across the board and it is being integrated especially in universities now a lot of the building courses, built environment courses

B: yeah

M have a sustainability module but its, its where do you fit it in you know what do you take out to squeeze that in and again it's just a

A: that's what I was saying you'd have to

M it a complex subject

A: to do it you'd have to filter it across the board rather than get rid of something to

M yeah its where universities are going to slip it in to their curriculum now you know what do they take out and what do they lose if they're educating people on this rather than something else, there's only so much time isn't there

A: but does it not come before universities though. Does it not filter down because a lot of college courses now are going vocational?

M Yeah

A: rather than exam

B: that's where it's hard to

A: and that, so that's vocational courses because whether you be a caterer and builder, I know it's sort of going off from the built environment but you know if you're a caterer where does my flour come from

B: yeah

A: where do the eggs come from? Do they come from the local farm you know? It filters in to catering as well as all through

M oh yeah

A: so perhaps it's sort of, further education is a great vehicle but perhaps it's sort of the age bracket to start challenging it to is maybe 16 to 18 year olds before, whilst they're just out of school, they're still wet behind the ears, they're still like a sponge soaking up everything that's around them

M yeah, no offence, you absorb more less

A: you know what I mean though

B: that's a good one. We're producing a kitchen, this is a project in Liverpool and speaking to the kitchen designer there's still an inherent issue with chefs, call them what you want. they go in turn the ovens on first thing in the morning because that's what they've done for the last 5/10 years and now with new electric ovens, electric cooking, induction cooking and stuff like that you don't need to do that anymore so the cost of running a kitchen, a sort of industry standard kitchen is substantially lower than it used to be. So there are other elements, not just us putting a building up

M yeah yeah

B: you know our consultants, the consultants we work with on M&E basis they're entrenched in doing everything, it's sort of weird in a way cos they're, their design philosophy used to be loads of air conditioning, loads of heating, loads of this that and the other. They're trying to design out their own services but they're doing it because of the environment and because that's

A: the rules

M yeah this is focusing on just construction, just because as you said before of the impact it has, it's got a, it has a huge massive impact on especially from the environmental side

D: it's a massive part of the

C: we could send everybody here your questionnaire couldn't we?

M yeah

C: is that not

M I did bring a few with me but I was conscious of time but I can email it to you or. I think if you go on the Bristol online link its, psychologically it looks, it's about this long, cos its two questionnaires and its created in to one and everyone just goes oh I'm not filling that in so I'll send the Word document I've got, but yeah it's the emotional intelligence questionnaire which you can measure and I can give you your scores back and let you know how emotionally intelligent you are

D: I'd like to be intelligent at something

B: yeah I'd go along with that

M and just the sustainable development one which measures your attitude towards it. That would be great thank you

D: just thinking about eco, my daughter's an eco-councillor at the age of nine so it is coming in to

M yeah they are starting to do a lot in schools I saw something on the BBC News the other day that you know the children think that fish fingers are made of chicken apparently so with schools educating them on and they've got a little gardens in lessons and they go in and make their own dinner and they educate them on where it's from and

OBS: it is you know in to the national curriculum

E: yeah it is

E: yeah I've got two school aged children

A: a lot of primary schools have allotments as well and things where they go and

D: the food analogy is probably a good one cos organic food is now getting a bigger and bigger part of the shelf life in the supermarkets isn't it

M yeah

D: and people, some people are prepared to pay that extra for it there's organic markets to go to which is becoming

D: more local produce

B: oh yeah

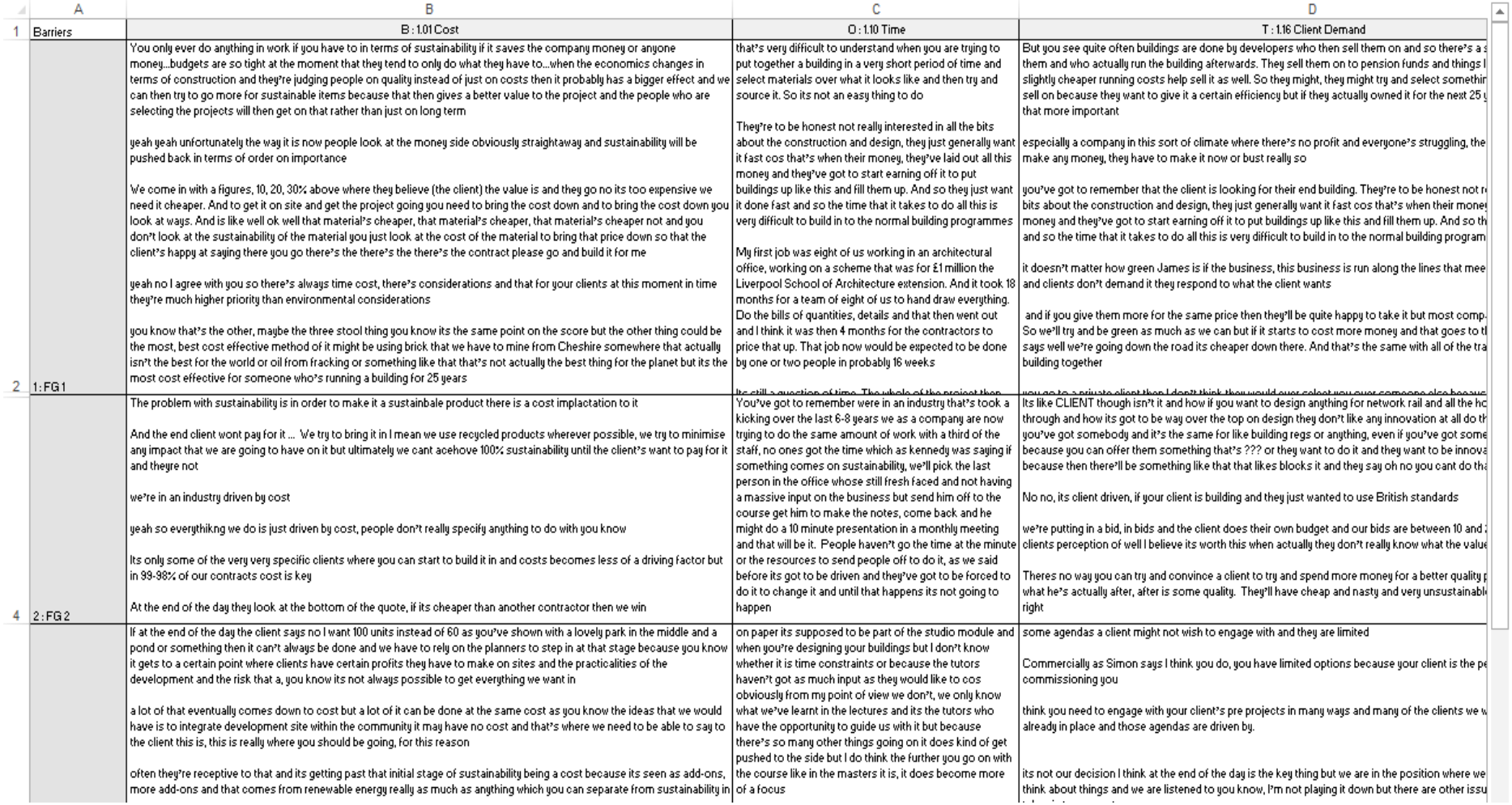
D: and you're more informed so you can make a choice

M well thank you

C: thank you

M and I'll email you those questionnaires over, it takes about ten, fifteen minutes.

Appendix 11



	A	B	C	D
1	Barriers	B : 1.01 Cost	O : 1.10 Time	T : 1.16 Client Demand
2	1: FG 1	You only ever do anything in work if you have to in terms of sustainability if it saves the company money or anyone money...budgets are so tight at the moment that they tend to only do what they have to...when the economics changes in terms of construction and they're judging people on quality instead of just on costs then it probably has a bigger effect and we can then try to go more for sustainable items because that then gives a better value to the project and the people who are selecting the projects will then get on that rather than just on long term yeah yeah unfortunately the way it is now people look at the money side obviously straightaway and sustainability will be pushed back in terms of order on importance We come in with a figures, 10, 20, 30% above where they believe (the client) the value is and they go no its too expensive we need it cheaper. And to get it on site and get the project going you need to bring the cost down and to bring the cost down you look at ways. And is like well ok well that material's cheaper, that material's cheaper, that material's cheaper not and you don't look at the sustainability of the material you just look at the cost of the material to bring that price down so that the client's happy at saying there you go there's the there's the there's the contract please go and build it for me yeah no I agree with you so there's always time cost, there's considerations and that for your clients at this moment in time they're much higher priority than environmental considerations you know that's the other, maybe the three stool thing you know its the same point on the score but the other thing could be the most, best cost effective method of it might be using brick that we have to mine from Cheshire somewhere that actually isn't the best for the world or oil from fracking or something like that that's not actually the best thing for the planet but its the most cost effective for someone who's running a building for 25 years	that's very difficult to understand when you are trying to put together a building in a very short period of time and select materials over what it looks like and then try and source it. So its not an easy thing to do They're to be honest not really interested in all the bits about the construction and design, they just generally want it fast cos that's when their money, they've laid out all this money and they've got to start earning off it to put buildings up like this and fill them up. And so they just want it done fast and so the time that it takes to do all this is very difficult to build in to the normal building programmes My first job was eight of us working in an architectural office, working on a scheme that was for £1 million the Liverpool School of Architecture extension. And it took 18 months for a team of eight of us to hand draw everything. Do the bills of quantities, details and that then went out and I think it was then 4 months for the contractors to price that up. That job now would be expected to be done by one or two people in probably 16 weeks Its still a question of time. The whole of the project then	But you see quite often buildings are done by developers who then sell them on and so there's a s them and who actually run the building afterwards. They sell them on to pension funds and things l slightly cheaper running costs help sell it as well. So they might, they might try and select somethin sell on because they want to give it a certain efficiency but if they actually owned it for the next 25 y that more important especially a company in this sort of climate where there's no profit and everyone's struggling, the make any money, they have to make it now or bust really so you've got to remember that the client is looking for their end building. They're to be honest not r bits about the construction and design, they just generally want it fast cos that's when their mone money and they've got to start earning off it to put buildings up like this and fill them up. And so th and so the time that it takes to do all this is very difficult to build in to the normal building program it doesn't matter how green James is if the business, this business is run along the lines that mee and clients don't demand it they respond to what the client wants and if you give them more for the same price then they'll be quite happy to take it but most comp- So we'll try and be green as much as we can but if it starts to cost more money and that goes to t says well we're going down the road its cheaper down there. And that's the same with all of the tra building together you go to a private client then I don't think they would ever select you over someone else becau
4	2: FG 2	The problem with sustainability is in order to make it a sustainbale product there is a cost implactation to it And the end client wont pay for it ... We try to bring it in I mean we use recycled products wherever possible, we try to minimise any impact that we are going to have on it but ultimately we cant acehove 100% sustainability until the client's want to pay for it and theyre not we're in an industry driven by cost yeah so everythikng we do is just driven by cost, people don't really specify anything to do with you know Its only some of the very very specific clients where you can start to build it in and costs becomes less of a driving factor but in 99-98% of our contracts cost is key At the end of the day they look at the bottom of the quote, if its cheaper than another contractor then we win	You've got to remember were in an industry that's took a kicking over the last 6-8 years we as a company are now trying to do the same amount of work with a third of the staff, no ones got the time which as kennedy was saying if something comes on sustainability, we'll pick the last person in the office whose still fresh faced and not having a massive input on the business but send him off to the course get him to make the notes, come back and he might do a 10 minute presentation in a monthly meeting and that will be it. People haven't go the time at the minute or the resources to send people off to do it, as we said before its got to be driven and they've got to be forced to do it to change it and until that happens its not going to happen	Its like CLIENT though isn't it and how if you want to design anything for network rail and all the hc through and how its got to be way over the top on design they don't like any innovation at all do th you've got somebody and it's the same for like building regs or anything, even if you've got some because you can offer them something that's ??? or they want to do it and they want to be innova because then there'll be something like that that likes blocks it and they say oh no you cant do tha No no, its client driven, if your client is building and they just wanted to use British standards we're putting in a bid, in bids and the client does their own budget and our bids are between 10 and clients perception of well I believe its worth this when actually they don't really know what the value Theres no way you can try and convince a client to try and spend more money for a better quality p what he's actually after, after is some quality. They'll have cheap and nasty and very unsustainable right
		If at the end of the day the client says no I want 100 units instead of 60 as you've shown with a lovely park in the middle and a pond or something then it can't always be done and we have to rely on the planners to step in at that stage because you know it gets to a certain point where clients have certain profits they have to make on sites and the practicalities of the development and the risk that a, you know its not always possible to get everything we want in a lot of that eventually comes down to cost but a lot of it can be done at the same cost as you know the ideas that we would have is to integrate development site within the community it may have no cost and that's where we need to be able to say to the client this is, this is really where you should be going, for this reason often they're receptive to that and its getting past that initial stage of sustainability being a cost because its seen as add-ons, more add-ons and that comes from renewable energy really as much as anything which you can separate from sustainability in	on paper its supposed to be part of the studio module and when you're designing your buildings but I don't know whether it is time constraints or because the tutors haven't got as much input as they would like to cos obviously from my point of view we don't, we only know what we've learnt in the lectures and its the tutors who have the opportunity to guide us with it but because there's so many other things going on it does kind of get pushed to the side but I do think the further you go on with the course like in the masters it is, it does become more of a focus	some agendas a client might not wish to engage with and they are limited Commercially as Simon says I think you do, you have limited options because your client is the pe commissioning you think you need to engage with your client's pre projects in many ways and many of the clients we w already in place and those agendas are driven by. its not our decision I think at the end of the day is the key thing but we are in the position where we think about things and we are listened to you know, I'm not playing it down but there are other issu

Appendix 12

From: Paul Murray [P.Murray@plymouth.ac.uk]
>> Sent: 13 September 2013 09:51
>> To: Brennan, Michelle
>> Subject: RE: The Sustainable Self

Of course Michelle; let me know how it all goes, and if you'd like a phone chat before running anything, do let me know.

Paul

-----Original Message-----
From: Brennan, Michelle [mailto:M.Brennan@ljmu.ac.uk]
Sent: 12 September 2013 22:25
To: Paul Murray
Subject: RE: The Sustainable Self

Hi Paul,

Further to my previous email, I'm just checking that it is ok to adapt your interventions in the pack? I have used your values circle and done a list of definitions with some of my own included.

Kind regards,
Michelle

Appendix 13

Sustainable Development for Construction and Property Students

Introductory Workshop

Name……

Age ……

Gender……..

Student ID……

Course of Study……

Year……..

Aims of the Workshop

- To develop understanding of Sustainable Development
- Connect with the sustainability agenda through discussion and activities
- Explore how our values, beliefs and attitudes impact on how we act in relation to sustainability

Outcomes

- A deeper understanding of sustainable development and the issues surrounding it
- An understanding of how we might become more empowered to act sustainably both in our personal and work lives through our values and beliefs
- How we might apply this in our working lives as built environment professionals

Task 1. Definitions of Sustainable Development

Over 200 definitions for sustainable development exist which is part of the problem of getting industry to act sustainably. Below is a short list of some of the definitions. Please read each one and think about which one best reflects YOUR understanding of sustainable development. Think about the key words and actions that YOU feel reflect sustainable development. If none of the statements below suffice please feel free to develop your own.

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

World Commission on Environment and Development - Brundtland 1987

"Sustainable development means encouraging economic growth while protecting the environment and improving our quality of life - all without affecting the ability of future generations to do the same"

UK Government

"A dynamic process which enables all people to realise their potential and to improve their quality of life in ways that simultaneously protect and enhance the Earth's life support systems"

Forum for the Future

An emphasis on social, economic and environmental wellbeing for people and communities, embodying our values of fairness and social justice. We must also look to the longer term in the decisions we make now, to the lives of our children's children as well as current generations

Welsh Government 2011

Sustainable development refers to the fulfilment of human needs through simultaneous socio-economic and technological progress and conservation of the earth's natural systems.

A.P Sage 1998

Sustainable development is all about ensuring a better quality of life for everyone, now and for generation to come, through: social progress which recognises the needs of everyone; effective protection of the environment; prudent use of natural resources; and maintenance of high and stable levels of economic growth and employment.

DETR 2000,

Task 2 – Pictures

In groups of 4 or 5 spread out the photographs and have a good look at them.

As a group think about what the picture is conveying and rank on a scale of 1-10 how the photograph makes you think about sustainability. As a group discuss why the photograph makes you think about sustainability and write down your reasons.

Photograph 1: Rank _____

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Photograph 2: Rank _____

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Photograph 3: Rank _____

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Photograph 4: Rank _____

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Photograph 5: Rank _____

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Photograph 6: Rank _____

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Photograph 7: Rank _____

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Photograph 8: Rank _____

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Photograph 9: Rank _____

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Photograph 10: Rank _____

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Task 3 – Circles of Empowerment

The aim of the next task is to get you to think about how you can make a difference.

Many of us believe that we are powerless to act in some situations and often uses phrases such as "There is nothing I can do" and "I can't". These are limiting beliefs in that they can limit us in what we are actually able to achieve. Even the smallest changes can make a huge difference and influence

others in the process known as the 'ripple effect'. Whilst we may not be able to stop climate change as individuals, each individual as a collective can significantly help to reduce it.

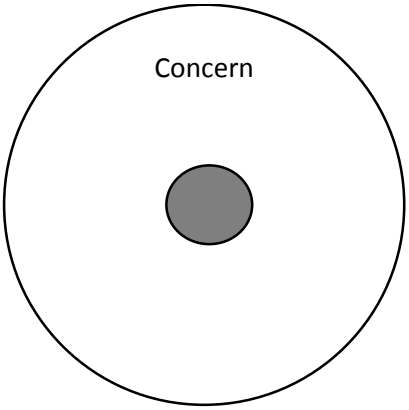
Self-limiting beliefs cause us to be reactive rather than proactive people. Reactive means we only respond to situations when we are forced to whereas proactive means acting in advance to deal with expected situations and difficulties such as taking proactive steps to reduce climate change.

This activity should help you think about personal empowerment and what you 'can do' to achieve positive outcomes.

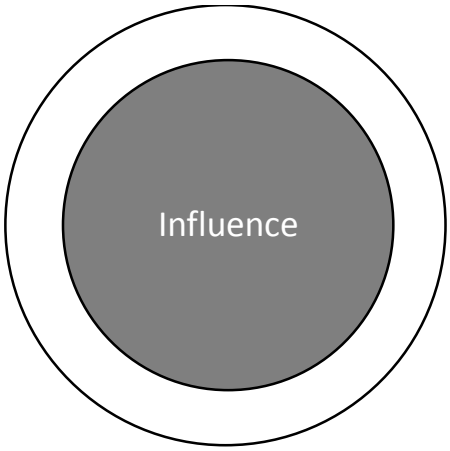
Below are some circles of concern. In your groups discuss what you 'can' and 'can't' do about poverty and pollution.

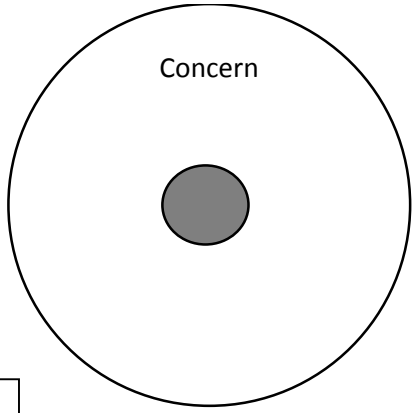
In the first circle imagine that your concern about the issue is large but that your influence is small. So you are really concerned about poverty but believe that that there is not much you can do to help alleviate it. Think about the things you 'can't' do and place them in this circle.

In the second circle your concern is less but you believe that your influence is large. So you are not really concerned about pollution but believe that that there is a lot you can do to help reduce it. Think about the things you 'can' do and place them in this circle.

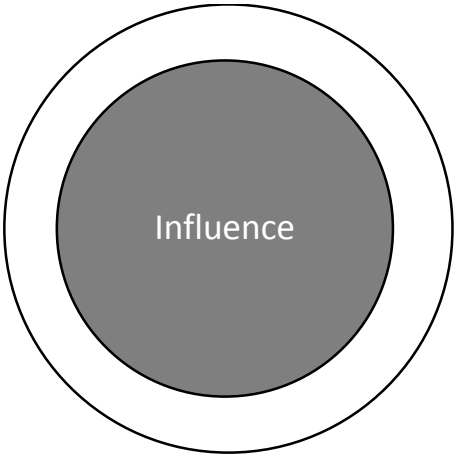


POVERTY





POLLUTION



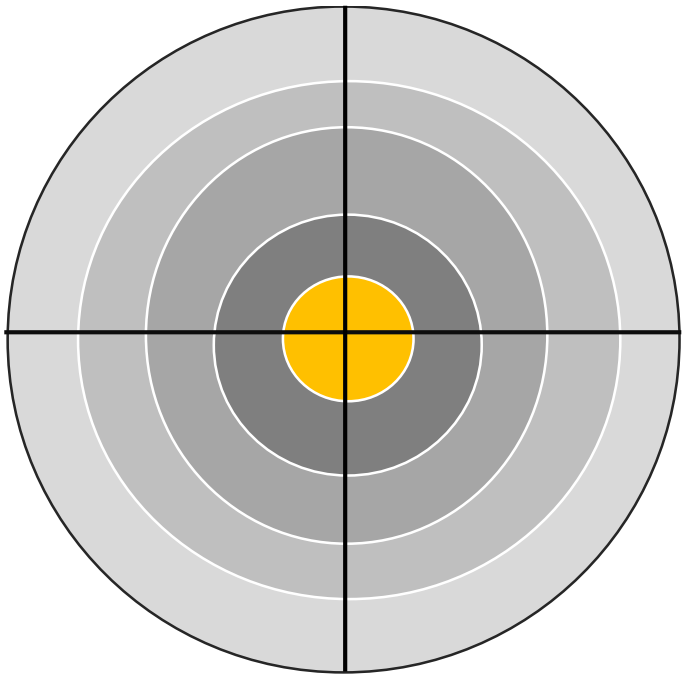
Task 4 – Values

A value is something that is intrinsically important to us in life. They are our ideals and motivators that determine the way we want to live and the way we carry out our lives. In some cases however we experience conflict between what we value and how we act.

Some values are more important to us than others and so they are hierarchical. Having completed the above tasks, think about your values. In the circle below starting from the centre working your way outwards, write down what you care about most. Below is a table of some values you might want to consider:

Achievement	**Fidelity**	**Love**
Adventure	**Financial security**	**Loyalty**
Ambition	**Fitness**	**Nature/earth**
Authenticity	**Forgiveness**	**Patience**
Acceptance	**Freedom Friendship**	**Peace**
Appreciation	**Friendship**	**Personal Growth**
Balance	**Fun Grace**	**Preservation**
Beauty	**Generosity**	**Privacy**
Bravery	**Good will**	**Purity**
Caring/Considerate	**Grace**	**Purpose (in life)**
Charity	**Gratitude**	**Recognition**
Commitment	**Health**	**Religion**
Community	**Honesty**	**Reliability**
Compassion	**Honour**	**Respect**

Confidence	**Humility**	**Responsibility**
Creativity	**Independence**	**Self esteem**
Diligence	**Influence**	**Spirituality**
Emotional well being	**Kindness**	**Stability**
Empathy	**Knowledge**	**Trust**
Equality	**Job/career**	**Understanding Tolerance**
Family	**Justice/Fairness**	**Wealth**



Look at the four values you have placed at the centre as being the most important.

Please briefly state why each of these values important to you.

……
……
……

Task 5 – Sustainable development and the built environment

Take a few moments to consider what you have learned and experienced during the workshop. In what ways do you think the built environment is important for sustainable development? Think about the discipline you are studying and how in your role as a professional you would incorporate sustainable development into your everyday work

……
……
……

Task 6 – Reflection

Please take a few moments to reflect on the activities undertaken in the workshop and provide your thoughts on the same. Things you might want to consider are:

How did the workshop make you feel?

Did it have impact on your thoughts as to sustainable development?

Are your values and beliefs congruent with your actions?

Have your views/perceptions of sustainable development changed?

Overall what was your experience of the workshop? Has it make you think differently about sustainable development?

……
……
……

Please take the attached questionnaires home with you and complete in your own time (15 minutes maximum) and return them to your module tutors at your next session.

Thank you and hope you enjoyed the workshop!

If you have any questions or queries regarding the workshop or in general regarding any of the topics or tasks covered please contact M.Brennan@ljmu.ac.uk

Appendix 14

Dear All

Michelle, my PhD student, is doing research into student attitudes to sustainability. She would like to do some sessions with our level 5 and 6 students. These would take the form of workshops and she would need to do 2 x 2 hr sessions, 1 in semester 1 and 1 in semester 2. The class would need to be in a classroom rather than a lecture theatre.

She will hand out the questionnaires then do some cognitive maps, do a picture session and try and relate it to aspects of the questionnaire and she needs to decide on a couple more tasks.

I would be grateful if any of you would allow her to do this in your module(s) it would only be for 2 sessions and ideally the modules that would be best are those that have some aspects of sustainability in them, but this is not essential. Please let me know if you would be willing for her to do this and can build it into your teaching plan.

If you are willing, dates, times and module numbers would be great

Thanks Alison

Appendix 15

Paired Samples T-Tests

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	SDAM Total	106.79	58	7.120	.935
	SDAM Total POST	108.72	58	7.013	.921
Pair 2	Environmental Subscale Total	25.45	58	2.854	.375
	Environmental Subscale Total POST	26.48	58	2.742	.360
Pair 3	Social Subscale Total	28.90	58	3.048	.400
	Social Subscale Total POST	29.81	58	3.137	.412
Pair 4	Economic Subscale Total	26.03	58	2.740	.360
	Economic Subscale Total POST	25.71	58	2.804	.368
Pair 5	Other Items Total	26.41	58	2.086	.274
	Other Items Total POST	26.72	58	2.246	.295

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	SDAM Total & SDAM Total POST	58	.681	.000
Pair 2	Environmental Subscale Total & Environmental Subscale Total POST	58	.683	.000
Pair 3	Social Subscale Total & Social Subscale Total POST	58	.655	.000
Pair 4	Economic Subscale Total & Economic Subscale Total POST	58	.533	.000
Pair 5	Other Items Total & Other Items Total POST	58	.201	.131

Independent Samples T-Tests – pre and post intervention attitude scores

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SDAM Total - SDAM Total POST	-1.931	5.644	.741	-3.415	-.447	-2.606	57	.012
Pair 2	Environmental Subscale Total - Environmental Subscale Total POST	-1.034	2.232	.293	-1.621	-.448	-3.530	57	.001

Pair 3	Social Subscale Total - Social Subscale Total POST	-.914	2.570	.337	-1.590	-.238	-2.708	57	.009
Pair 4	Economic Subscale Total - Economic Subscale Total POST	.328	2.678	.352	-.377	1.032	.932	57	.355
Pair 5	Other Items Total - Other Items Total POST	-.310	2.742	.360	-1.031	.411	-.862	57	.392

Group Statistics

	Bravery	N	Mean	Std. Deviation	Std. Error Mean
SDAM Total	No	44	107.41	7.419	1.118
	yes	14	104.86	5.908	1.579
SDAM Total POST	No	44	109.61	7.428	1.120
	yes	14	105.93	4.698	1.256

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SDAM Total	Equal variances assumed	1.144	.289	1.172	56	.246	2.552	2.178	-1.810	6.914
	Equal variances not assumed			1.319	27.245	.198	2.552	1.935	-1.416	6.520
SDAM Total POST	Equal variances assumed	6.352	.015	1.743	56	.087	3.685	2.115	-.551	7.921
	Equal variances not assumed			2.190	35.176	.035	3.685	1.682	.270	7.100

Group Statistics

	Fidelity	N	Mean	Std. Deviation	Std. Error Mean
SDAM Total	No	51	107.43	7.089	.993
	yes	7	102.14	5.843	2.209
SDAM Total POST	No	51	109.29	7.027	.984
	yes	7	104.57	5.740	2.170

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SDAM Total POST	Equal variances assumed	.950	.334	1.884	56	.065	5.289	2.808	-.336	10.913
	Equal variances not assumed			2.184	8.627	.058	5.289	2.421	-.225	10.802
	Equal variances assumed	1.461	.232	1.698	56	.095	4.723	2.781	-.849	10.294
	Equal variances not assumed			1.982	8.677	.080	4.723	2.382	-.697	10.143

Appendix 16

C	D	E	F	H
Portrays unfair living conditions and therefore is unsustainable from a people point of view as they are not experiencing a sustainable way of living	Similarly this is unsustainable as it shows how people globally are unfairly treated. Not have the option of an infinite tap at home	Unsustainable way of fishing or polluted water contributing to death of fish. Proves that our actions aren't sustainable and nature is being jeopardized for our benefit	Similar to H poisonous gases escaping into burning fuels. Not sustainable as destroys the ozone layer	Burning fossil fuels. Contributing to GHG and the earth's atmosphere damaging the ozone layer
It seems to be a population living slums. Therefore inequality is	This picture is showing a woman most likely having to walk a distance for	A lot of dead fish therefore must be a lot of pollution in the water. Most	There is a lot of smoke in this picture. I think it seems to be coming from a fire.	This makes me think about environment being unsustainable. It looks like there is a

occurring. Most likely to be a limited supply of drinking water, food, cleanliness. Basically poverty.	water I heat showing a lack of equality	probably caused through waste disposal from power plants and facilities	This would cause pollution in the air eventually causing harm to the environment	lot of pollution being caused by power plants. Its seems like a lot of energy is being used which is affecting the climate
This could either show a natural disaster such as a mud slide or storm or it could show a poverty stricken country	Water looks quite polluted and area is very dry due to possible drought. Woman has probably travelled very far to get water	All of the fish have dies from possible pollution. These fish would not be suitable to be eaten causing famine and also put people out of business causing poverty. Water is very damaging when polluted which is why waste water must be treated properly	This picture shows visible pollution from effects of possibly burning fossil fuels. This pollution is a major factor of global warming which is a huge issue. Can also cause issues to people's health to animals and plants	Although H is very similar to F it doesn't give the same effect as from a distance it doesn't look as bad. This is still bad as this type of pollution would cause global warming
Natural disaster caused by flooding which could be as a result of global warming	Possible drought due to global warming	You can see how pollution can affect people's livelihood and wildlife around the polluted area this will affect the food chain	You can see visible pollution, can cause harm t people's health	Same sort of scenarios as picture F. But the effects aren't as visible to humans. Although you can see the scale of the operations and where it is going
Doesn't look related to sustainability – my guess would be a natural disaster	Looks like a drought has occurred. Crops all dry and travelling to fill up water from well	Look at the wildlife harmed by pollution which will have a knock on effect to humans eating the fish	You can visibly see pollution from the source and people living in that environment. Can cause harm to both humans and the environment	Same as picture F but the photo doesn't show humans in the photo so it has a different affect although still bad
Refugee camp millions of people with no home. Has massive social issues	Drought so water has to be saved from wells. Might be dirty causing sickness	Water pollution effecting stocks which affects the economy	Factory burning fossil fuels creating fog air pollution	Large scale air pollution creating massive amounts of CO2
Refugee camp, this could be due to war, political or religious issues. This is a social factor but not always related to sustainability	This picture relates to 3rd world poverty and this unfortunately has been happening for many years – women having to source water	Climate change causing sea levels to rise due to ice melting. Environmental issues which is an element of sustainability or pollution in the water, a cause of industry	Pollution, I personally think of carbon and carbon footprint	Could be a tornado or could be pollution. Not an impact to me
Represents poverty which is as a result of maybe the current industry in that country	Woman carrying water well. This has got to be related to 3rd world conditions	Fish flooding the water could represent a number of factors. Could mean that the water has been polluted although this could help the local	To me this photo seems the most important, it shows businesses are still polluting the earth with no due care	this photo has a negative impact on me due to the large amounts of smoke entering the ozone layer

		community in sourcing food		

I	J	K	M	N
Unsustainable in terms of people being subject to living in these unhygienic conditions and perhaps having to hunt for food	Shows unsustainable economy in terms of people and society and how it is being developed in terms of jobs and well being	Could be referred to as sustainable water is being conserved for use therefore not being wasted. However also unsustainable as not fairly treated as people are able to have infinite amounts elsewhere	Image shows poor living/ground conditions not a healthy or sustainable way of living	Shows polluted river/water. Refers to plant pillar and unsustainable use of natural resources
This shows a dead animal showing me that there is no food or water around. Probably caused by globally warming	This shows that there is poverty occurring which is being caused by the current economy. It also shows northern rock which is a bank that has recent had mass problems	This picture caught my eye because it was a tap with a padlock on. To me this shows that water has become sparse indicating that natural resources are low		
I think this picture shows an animal that has died possibly from a lack of water or vegetation which again could be caused by a rise in temperature. This will also affect people who use the animals for food.	This shows a regular sight in this country. This could be due to not enough jobs or houses, however in my opinion there is no excuse for ant to not work or live in a home.	Tap has been padlocked possibly due to a drought caused by rise in temperature from global warming. Need to use sustainable energy rather than burning fossil fuels	Crops have been destroyed by flooding possibly caused by global warming. This not only affects us as we get crops from other countries but many people may depend on these crops just to stay alive	Showing a water source that is massively polluted. This causes damage to ecology. Animals that not only live in the water but also drink from the water. The water is being pumped out onto the ground which is very damaging. Can also destroy peoples lively hoods as shown in the next photo
Could be as a result of no water and animals are dying therefore having an effect on the food chain	Common sight in most UK cities	The same principal as picture M. the water has been stopped possibly due to a drought therefore affecting people's ability to grow crops and live	Has global warming caused this land to flood. Therefore no way to make money as he has no job	The water isn't very clean and it is being cleaned out and could cause harm to wild life and peoples livelihood
This land is bare and dry, the only food in front of them has been taken to pieces	Quite a common sight in most UK towns and cities	Water being essential in life, a lock on tap is uncomfortable	Floods have caused problems with the economy e.g. crops now flooded, no food or money	You can see some sort of pollution from the colour of the water. This will affect the water and all surrounding life

Cattle could have been killed by another animal for food	Banks collapse down to economic downturn	Drought, no way for crops to grow for food or exports	Poor farm land so no crops for the future	Waste from factories running into the water course. Has massive impacts on the environment
Carcass in the dessert - not necessarily related to sustainability. In my opinion this has always happened and could be a natural death	Economic crisis. Makes me think of 2007 when the financial crisis and related to sustainability as profit is an element	When thinking about this picture, could be considered as using less water	A hot country that has probably had a monsoon. Climate change but don't really think about sustainability	Pollution which is linked to environment. One of the elements of sustainability
The animal could have died through lack of water which in turn could have been the result of drought or it could have been natural death	Homeless man, maybe economic issues here	This picture represents the fact that water is available but at set times, maybe rations which represents maybe a drought in the area which comes down to the environment	Maybe a flood here which is usually related to the environment	This photo shows a local sewage plant which a pump in use extracting the water. The water looks polluted which in turn has a negative effect on the environment

Appendix 17

Poverty

Concern is large but influence is small (students believe they cannot have any influence in solving these problems)	**Concern is small but influence is large (students believe they can have some influence in solving these problems)**
Stop poverty	Donate to charity/food/clothes/money
Stop global warming	Provide assistance
Cure disease	Provide wells for clean water
Provide water	Educate
Provide homes	Use natural water
Provide food	Buy fair trade
Stop use of fossil fuels	Stop using fossil fuel
Stop deforestation	Stop polluting water
Create/provide jobs	Stop burning fossil fuels
Ensure everyone is treated equally	Don't waste water
Give everyone money	Engage in local help schemes
Develop a poor countries way of living	Buy from poor countries
Change attitudes	Spread awareness

Donate sustainably	Provide resources
Provide resources sustainably	Deliver aid
Redistribute wealth and natural resources	Give them chlorine tablets
Ensure producers get paid fair wage	Reduce impact on climate change
International trade	Reduce energy use
Change taxation	Write to the government
Change morals of big businesses	Convince governments to help
Get people to work	Convince private sector to help
Provide housing	Provide infrastructure
Help much about natural disasters	Charity work
Change cultural perceptions	Lobby MPs
Fix all problems straight away	University set up trips to less economically developed countries and get grants to help community. E.G Civil engineers to build infrastructure – helps communities and students in getting work experience
Convince governments to help	Reduce but not eliminate poverty
Political pressure	Create safe ground to grow food
Change government spending	Volunteer
Influence markets	Share knowledge
Prevent corruption	Buy from poor countries
Provide sustainable infrastructure	Funding education into how society can tackle poverty
Provide medicine for everyone	Provide aid
Control debt	Provide solutions
Cant ensure donations get to those who need it	Provide healthcare
Can't decide what prices are fair trade	Provide food
Feed everyone	Educate
War	Charitable donations food/clothes/money
Costs too much to eradicate poverty	Children in need
Help with erosion due to sun rays	Comic relief
Governments influence on other countries	Help the homeless – free food
Redistribute wealth	Recycle
Industrialise	Charity work
We don't make a difference	Personal sustainability

Make other countries governments care	Food banks
It's out of our control	Volunteer for refurbishment
Guarantee gift aid goes to right place	Develop living areas
It's too profitable for western governments	Had the capability to end poverty for years
Problem increasing in scale	Use money from cigarettes and alcohol to provide solutions for countries to bring themselves out of poverty
Stop world hunger	Build schools and hospitals
Help everyone	Give a man a fish scenario
Stop people getting selfish	Build low cost housing
Happens even in developed countries	Donate
Equal distribution of wealth	Create jobs
Prevent death due to lack of healthcare	Distribute food equally
Force people to change their lifestyle	Provide jobs
Free the world of war	Stop deforestation
Pay global debt	Feed the homeless/ Build homeless centres
Eradicate third world poverty	Employ the homeless
Change the political landscape	Donate to food banks
Feed the world	Set up safe towns
Stop greed	Charity events
Have a major impact	Spread the word
Give them clean water everyday	Support charities
	Spend 2 weeks abroad helping
	Raise money
	Recycle
	Supply water mains
	Social redevelopment
	Waste disposal systems
	Reduce contamination
	Basic food packages
	Create health centres

Pollution

Concern is large but influence is small (students believe they CANNOT have any influence in solving these problems)	**Concern is small but influence is large (students believe they CAN have some influence in solving these problems)**
Stop Carbon footprint	Walk
Stop Climate change	Save energy/reduce consumption
Stop icebergs melting and sea levels rising	Cycle
Deforestation	Monitor and reduce carbon footprint
Use of fossil fuels	Recycle
Stop LEDCs from polluting environment	Find renewable energies
Change legislation in other countries	Use car less
Poor waste management	Turn appliances off/ Be more energy efficient
Sourcing of materials	Public transport
Nuclear	Use sustainable methods of construction
Make other countries care	Use sustainable/recycled materials
Stop large industries from burning fossil fuels	Education/awareness
Stop china	Local labour
Behavioural change	Grey water harvesting
Control personal resource use	Better waste management
Green taxes	Raise awareness of damage being caused
Lack of global commitment and cooperation	
Control big business in other countries	invest in personal sustainable energy resources for homes
Building of industrial power plants	Funding more studies into more viable energy sources and how they can be applied nationally
Influence other countries to go green	Encourage stronger legislation and enforcement of policies for organisations
Offer alternative energy systems	Better health care
Control companies/energy companies	The future of the industry
Replace old factories to modern eco factories	Wind power
War	Hydro power
Cant reverse effects	Contribute to technological advances
Stop production	Don't litter
Cant increase natural resources	Use Less water
Can't get rid of all pollution	Eat less meat

Can't have 100% renewable resources	Fly less
Stop growing dependence on power	Power – use green tariffs
Shut down factories	Increase renewable energy
Use of coal power stations	Reduce resource usage
Land fill	Go vegan
Waste/oil into the sea	Greater legislation/regulation to tighten up on pollution at domestic and industrial level
Change taxes	Global treaties to reduce pollution
	Avoid purchasing from 'known' companies which continue unsustainable practice
	Source products locally
	Re use plastic bags
	Repair old items
	Use alternative methods to reduce carbon footprint
	Use energy saving devices
	Sustainable technologies
	Passivehaus
	Legislation
	Conserve power
	Sustainable attitude
	Use green energy tariff
	Driver lower emission cars
	Reduce fuel consumption
	Don't have gas or heating on
	Switch off lights
	Save water
	Implement waste saving in work
	Lower co2 emissions
	Nuclear power stations
	Installation of solar panels on new buildings

Appendix 18

	N	Mean	Std. Deviation
Adventure	17	2.82	1.468
Ambition	27	2.15	1.134
Acceptance	13	4.08	.862
Appreciation	18	3.72	.895
Balance	11	3.64	1.120
Charity	10	3.30	1.337
Commitment	15	2.93	1.335
Community	12	3.25	1.422
Equality	19	2.84	1.068
Financial Security	24	2.04	1.083
Friendship	36	2.36	1.046
Gratitude	10	4.20	.789
Health	43	1.77	1.109
Honesty	26	2.50	.906
Humility	9	3.22	1.093
Knowledge	24	2.54	1.351
Justice/Fairness	13	3.15	1.281
Love	27	2.26	1.228
Loyalty	22	3.23	1.152
Nature/Earth	12	2.00	1.279
Personal Growth	21	3.24	1.446
Preservation	8	3.38	1.408
Purity	6	4.17	.753
Religion	11	3.55	1.864
Reliability	9	2.78	1.202
Self Esteem	10	3.00	1.414
Spirituality	7	3.57	1.397
Trust	26	2.35	1.018

Appendix 19

MB So how do you think this would this translate into industry, would the tasks work, are they too low level, do they need something more?

AA So the purpose of this tool is to teach SD

MB It's not about implementing SD into their projects etc., it's about the why not the how, it's not about how do we build a sustainable building it's about why should we be building sustainable buildings

KH And whose it designed for?

MB I designed this for use with students because industry told me it's going to have to come from education

TW So this is an output from your research, industry told you actually we need to be influencing people before they get into industry

MB Yes but obviously there are a lot of people in industry right now who make the decisions and it will be a while before the students we are educating are in those positions

AA Right so used at different levels then, can this be used at the educational level and also is it transferable to industry

MB Yes

AA Well you're dealing with different people, I think you've got more malleable minds in education because people are more open to ideas that would be probably slightly more tuned into issues of SD whereas if you're talking about older people who've been in the industry for a while they'll probably be more cynical about these things, yeah you're going to come up against different challenges aren't you

MB Yes completely which is which I am seeking your advice as to whether you believe this would be useful with industry professionals, so the picture task for example that was a really good task the students really engaged and enjoyed that. Do you think that is something industry professionals would engage with?

AA I'd be wondering about the choice of images and why, I'd be wanting to know why, there is clearly some reason behind them obviously that's socio economical

MB Well that relates to poverty and everyone ranked poverty as the lowest as though it's not important

AA Is that because of what people understand sustainability to be?

MB Yes they don't understand it as a holistic approach, they still very much focus on the environmental. So this was to challenge those perceptions and they were given the debrief after

AA It's just good to understand where all this derives from to put it into context, so would that work with industry? Just looking at the next task I'm not really understanding this task can you explain that to me?

TW So those two circles related to poverty, something you think is a big concern but you've got little influence over, and something that is of a concern and you have big influence but you're not really concerned about it

MB Yes, so they discussed that in groups and then wrote down their own individual answers

TW Is there any reason why you just chose pollution and poverty for this task?

MB Time limits and just to get start to get them to think about their influence as it leads onto task 5

AA And what does that tell you about them?

MB Well it was more again leading onto task 5 getting them to think about what they can do in their jobs that they can do as professionals with SD

AA Right got you so this is more a theoretical that leads into the more practical?

MB Yes, for the analysis I created lists of everything they wrote and did an explanation and synopsis of this

AA Right ok and the next task

MB This is the crux of the thesis really, what's important to us and why SD, our values link to our attitudes

TW So it's just a task to ask to get people to say what they value

MB Yes but they start to think about what's important to them in the process

TW Does it matter which section or is it just more about the distance from middle outwards, the quadrants don't matter

MB No just distance from middle outwards, but then their top four going in the middle you see

KH You've asked a question whether it's had an impact on their thoughts and views, is that what it was designed to do?

MB Yes

KH So the idea is they come to this workshop and having worked through those activities it will alter their attitude towards SD?

MB Yes its thinking about it is a different way that they perhaps haven't before

AA I was going to say it's more about challenging their current belief to say is that right or is that, not necessarily the right one, does it reflect what SD actually is but I don't know whether, because I'm just thinking about the way in which you're trying to do that, the pictures for e.g.

which seem to be for me the strongest influence in that, you know it's a very, we respond to visual cues, is that, are those the right pictures, I'm kind of drilling down to the detail and I look at them and I go really? Where have those come from, do they really capture all the aspects of SD

MB So the pictures would need more of a background context?]

AA Yeah I think so because I think it's why have you chosen, I look at them and I think ok they've been chosen for a reason because if you're doing a scientific study like this you'd want to have something that's going to stimulate a particular response and I just don't understand why these, maybe I'm thinking about it in too much detail because it's my area

KH How do you run the workshop? In terms of each activity what do you do? Do you introduce it or do they literally just work through the book? Do you give them any verbal instructions or do they literally just read the book and is there any information between the activities or do you just go from activity to activity?

MB They're placed in groups of 4-6 depending on the class size and I ran through what the workshop would entail. They were told a timeframe for each task and that I would be stopping them in between in each task before moving on the next one. So they had 15 minutes for the first task which after this time I stopped them and made sure everyone had finished and then I moved them on to the next task and so on etc. As they were completing the tasks I went around the room speaking to the students and asking them what they thought challenging these thoughts but not giving them answers in order to provoke some different thinking

TW So the question you're asking us today is would this work in industry to change attitudes, so the question is did it create any impact?

MB Yes there was a positive change in attitude post intervention

KH So you did a pre questionnaire and post questionnaire but you hadn't told them at any point that you were trying to change their attitudes

MB No

AA And from your research was there a shift?

MB Yes

AS And the question out of this is do we think this is appropriate to take from what you tested with students to industry professionals?

MB Yes so for example the values task, getting them to think about what is important to them this values are something we never consciously think about so getting people to actually think well what is important to me

TW Isn't the stuff what you've done just saying how they feel right now? You haven't introduced anything that moves them on

AS To me this is the middle bit, you've got to present or get them to tell you what their understanding of SD is then take them on that journey through this,

MB So maybe not give them the definitions but write their own what they believe SD to be?

AA And this is when you first presented those ideas around the definitions and there are over 200 and you've given them 6 of the more popular ones some of which we'll be familiar with but they were all kind of variations on theme really, it's just the same thing said slightly different and I just wonder whether actually there's an opportunity to shake that up

MB In what way

AA In that in respect of, what did you get out of their answers to question one for example?

MB They chose mostly the Government ones, Brundtland or DETR. None put their own

TW I don't see anything in there that tends to move them on by the end of the workshop, it only gives their current thoughts and feelings as they feel right now based on their sets of values

AA Which in a way is a good first step because it you want to influence people you want to know what their current belief set, current state of mind is

TW So was the purpose of the workshop was to change the attitude a bit?

MB No ongoing – but a limitation of the research is that I didn't go back and check

AA In terms of the approach that you've taken because you've obviously got, essentially 5 tasks to change their attitudes, do you feel on the basis of the research that you've done and the evidence that you gathered to put this together that that provides enough of a, are those enough steps to be able to change someone's attitudes

MB Having read the literature around attitude change and what works I believed for the context in which it was used yes, whether that would lead to long term change, but having now done it and looking back over everything although there was a shift in attitudes something more may be needed

AA Right ok that helps put it into context, so this is more of a starting point, almost establishing a baseline really and it has to be followed up by something a bit in-depth and a bit more rigorous and you then take, so say we were all the MD's of BIG companies and we say you need to do something about SD become greener as companies, you need to take people on a much more rigorous journey I think in order to change their attitudes because for me all that does is give you a snapshot of how their feeling, which is fine because you need to do that and if you're sitting with big influences you want to know where they are at the moment so you can start to, if you are going to change the way they view things you can start to poke at the things that you know are important to them

KH It's a bit like personality profiling I do

TW It's a bit like the do you believe in climate change presentation I do, we show that image which provokes thought at the start and everyone goes yeah, yeah I believe it but during that process we say ok if you went into a supermarket and the more sustainable product cost more would you choose it and everyone goes no, but they all put their hand up at the start because they see the image of London under water and all want to combat that but when it came to choosing orange juice off the shelf their not choosing the sustainable choice

MB So whether this then translates into sustainable behaviour

TW Yeah

AS So for me though the question you did at the front end, the responses you would get from industry would predominately be negative, so I would say that as a starting point, because there's people that don't understand, similar to BIM, similar to Lean what SD actually is, they think it's just the green bit

MB So you think that they need a brief introduction

AA Well I think that the interesting thing is to get their initial understanding because, and I think that's why I think you need more varied definitions, you've essentially got 6 of the same definition

MB All the students have a sustainability module so they have a basic understanding, but with industry they would need a brief intro

KH To show individual differences what you could do is you could take those 6 definitions and give them some other ones you could give the Brundtland and the DETR because those are two good ones and then give them some which say about SD is about stopping pollution, it's about producing less waste and then you can pick out how people view sustainability

MB So use buzzwords?

AA Yeah because people view SD in different ways, there are people who have a much more holistic view who will pick out the ones that take into consideration the economic environmental and the social and stuff and then there'll be others who do believe yeah it's about producing less waste, making sure we recycle our green bottles

MB So need more of a variation in the answers?

AS I think your statements would have to cover the economic and the moral etc. separately to see which they view SD more as

TW choosing orange juice off the shelf, which one would you choose, ask them to say why. But then you'll find when you look at peoples values you'll probably be able to correlate some of those choices based on their values as well

MB But they've just done the picture task which made them think about poverty and not having enough money and how environmental impacts impact this, and then they're thinking about

values and what's important to them so they'll already hopefully have that going on in their mind. In a different situation of course their values choices might have been different

AS In and industry facing workshop where you've got to take them on that journey

KH Yeah you have to take them on that journey

AS Economically morally which one are you drawn to and then you can build on what you've generated as your questionnaire, not give the answers but make sure that the understand SD isn't just about putting grey water harvesting into our buildings its bigger than that its more than that

TW It's changing our values and changing some of our choices around them isn't it. Because that's the challenge we all face, we have to take a different, when were presented with situations the current behaviours don't make the right choice

KH This is a bit like our personality profiles, you can do the profile but that's fine but it just sits on a shelf gathering dust and you don't do anything about it, what this does is tell you what our personality profiles do, but the value in there is then how do you use that information to change the way in which we interact with each other, and you kind of jump from task 4 to 5, you've done the kind of who are we, challenged their beliefs and started to elicit what their beliefs are based on and some of their attitudes and then you've said that having done that how does that make you feel about what have you learned and I just wonder whether is that a bit of a step too far within this given that as we said you want to take them on a more detailed journey

TW That for me is, the students that you've put this to have been programmed already to start thinking in that mentality if that's what they're doing on their course, if you go out into industry I think you need to show people actually you might need to be reconsidering how your programmed and this is what it looks like and then you're doing this to gather the evidence back from them and as AA is indicating there I think giving them the influence for the journey ahead because I just think again similar to BIM there's so much misconception about what SD really is

MB So they need a 10-15 minute presentation on what SD is?

AS More to get them prompting their thought patterns, don't give them the answers to what it is, just say SD contains economic, social and environmental, fully flavoured by all, because if I'm talking about cores values and beliefs I'd align to one more than the other, yeah, it could be moral that is my core belief that's driving it forward but an MD of a company might be well actually its economic for me

AA It also kind of slightly catastrophizes things, it very much presents the world's problems to you, so you're kind of going oh this is bad, oh this bad to each picture

KH If it was being delivered in industry what purpose would it have, who would want it, why do you have to look at it in relation to industry, who wants it

MB Well industry don't want but we need to change people's attitudes regarding SD because nothing is being done, whether how it would be implemented either training course or CPD this is where the research comes in

KH So you couldn't do the, you're not telling them it's about changing attitudes before or during because people would have to choose to come on it wouldn't they in industry

MB Well I only measured that for my research so I have tangible outcomes but if it was to be delivered in industry then perhaps you wouldn't have to measure them

TW So let's say a post office came to me, Royal Mail, and said we want to change attitudes in our business would you start with a workshop like this,

AA No I'd start my understanding the business a little bit more and understanding the culture within, that's what, that's how we start it,

MB But this is focused on construction specifically only though

AS Prior research has been done I presume saying that culture and behaviour is a requirement for SD, it's a key theme that needs to be addressed in the industry that's why you're looking at this?

MB Yeah

AS So if I was going to do that workshop I would get people to tell me what they believe SD to be and then get them understand what SD is, tell them about it

AA Well actually that's what, I think that's what this is trying to achieve but it's a case of, it's not saying what would you do it's a case of is this, does this approach work based on from an academic rigour, so Michelle's doing research , so we've got to club our practical, so if you were to look at it and you're coming from an industry background going this is how we would do it, this is more about does this approach have academic rigour because that's what your PhD will be judged on

MB Yes but I want to know can this translate into industry but also if you feel that any additions are necessary or anything you just don't feel would work

AS Would this workshop work in industry

AA Yes so the question isn't how would 'you' would do it, the question is based on what this is trying to achieve could it be yes translated into an industry context

MB Yes so if I set a group of architects down say do you think that they would think that these tasks are too simple, do you think its high level enough?

AS In that format for me, you would get people going I don't understand what you're asking me to do with this

AA I think your right I think you'd have to put it into context in terms of what you're trying to achieve. You wouldn't necessarily give them any information about SD in the first place

because then that's too much trying to influence their, actually this is that first step in trying to understand their perceptions

AS But haven't we done that with the pre-questionnaire

TW I just think its drawing out how I currently feel I don't know whether it's changing how I feel

AA And actually this is then obviously the next step on the basis of what this elicits from your participants, you design something which will change depending on what their attitude and view is

KH So you've done the research, you've got, behind each one of these activities you've done research and that's why you've chosen that activity so which of these activities did you choose because they would influence changes in attitudes

MB All of them, they build on each other to begin to personalise SD, thinking about what's important to us and so why it's important to act sustainably to try and preserve those things,

TW I like the profiling aspect, You mention that the slightly egotistical members of society had less positive attitudes, so if you ran this on a premier football team for instance you'd probably think don't care, they'd like the picture of the diamond, whereas if you ran it on our section of industry, your architects might be caring and sharing but it sets a baseline, because if you ran this with a contractor you'd have a profile of what's in that contractor because that contractor has got a load of egotistical people, then they're not going to be able to transform because they're going to be more interested in screwing the client and getting the money out of them

MB So on the values you would do a more robust analysis

AS I think for me there's a little bit of an element that you'd have to spoon feed them at the start. I think you've got to open with the social, economic and environmental, I'm not saying give them social but just say actually guys SD is social, economic and environmental, not giving that detail but letting them think about well actually that picture I just aligned to that now, when you showed me that picture it brought it home to me so that will show me that there is a transition, because I've started to shape, so if I'm sat at the front end and I don't understand that there are the different elements of SD I can't change my behaviour on this journey because I'll just stick to where I am so I think you have to open with that

AA Well that's almost what your trying to find out what they are

MB Well that's what the pictures task set out to do, think about the interconnectedness of the issues, one of my findings was that the pictures relating to poverty they didn't link that that to SD at all

AS Because the amount of times that you hear comments around sustainability, SD, that green rubbish

AA Well that's the thing you don't want to influence them too much you want to try and understand whether do they think it's just that green rubbish because a lot of people probably

will do, so if you tell them it's about the other elements too and then say now you tell me what you believe SD to be

AS Yeah so you would still do the questionnaire to gauge responses and where they are at based on that, you get that back saying it's just that green rubbish you go and say well actually guys it's a lot more than that, we are going to go through a change workshop, and then we come out the other side and reflect against AS

AA Is it worth us seeing the questionnaire because then we can see what you did and understand the outcomes

MB There are four subscales, 7 on each aspect of SD and then 7 on Government and education issues so in filling that in they're already starting to think about what they think about these issues anyway

AA So this is the questionnaire they completed pre and post, right on the basis of their outputs this gives you a measure of their attitudes towards SD. The interesting thing for a piece of follow up research would be ok if we think as a group the workshop that you put together is more of a fact finding exercise around attitudes and beliefs and actually if you want to change the way people perceive and behave there's an additional intervention to do the difference between how you've done it so far and how it could be done if there was an additional intervention

MB Yeah if it needs that change

AA Not necessarily saying it needs that change but as a piece of research it would be a nice comparison to do and as a company paying for training or CPD you'd want to know if it's the most effective way so measuring is a good idea

MB I know you say its only fact finding but the results of my research indicated that those tasks appear to have had some impact on their attitudes post intervention

AA Oh absolutely I agree with you because the more I think about it actually I think those images have been chosen because they provoke a reaction

MB They're not necessarily what you think they are

TW How does this conclude with us now?

MB I need to know whether this can be used in industry and if not what you would change about it, so task one I would need additional definitions that cover separately the elements if SD to gauge more robustly individual differences on their current perceptions of SD?

AA I'd shake it up a little bit yeah

TW The big question is, if we were asked by a client to help change attitudes across their organisation towards SD would we use it

AA I think what you've got is that you've got an approach that's been developed an approach with a lot of stuff to back it up and tested in a scientific way which demonstrates that it has

some impact, on the basis of what you've got could you potentially build on it. The questions isn't, don't get us wrong this is not meant to be critical at all its more about there is a basis for something to be developed

MB So you feel that it's suitable but we think it needs building on

KH I think yeah but not in its current form

TW I think you could definitely use it, I like the format, it's a longer version of my do you believe in climate change question, what I would change is introduce something in the second half, if you were going to push this out to industry is something that actually tries to create the shift in terms of maybe using scenarios or other tools and techniques to challenge them in the process so that by the end of workshop they actually may go away and take some new behaviours away from the workshop, I don't think that it does that enough currently

MB So time wise in developing a more elaborate model how much time would you allocate

TW I would say half a day to a day with our clients and I would that there's definitely components of this that would work, I like the images in particular because I like pictures and makes me think about things

AS It's a half day workshop definitely, so what you've got there is a baseline format of a workshop that can developed for industry with the backing of the academic approach its developed from and it's just taking into account what you would encounter in the industry, for me if you ran that workshop now, you might see one step increment change on the responses to the Q whereas what I would be aiming at is wanting to shift them up by either 2 or 3 increments heading towards scores of 5, you might get a small shift change with what you've got now with someone going you know what I never got that bit of SD so I've gone from a 2 to a 3 but I think there is more that could be added to shift them to a 4 or a 5

TW I'd make it more, rather than getting people to write down their thoughts and feelings I would get them to do something like the run around activity which I use

AA I was going to say actually the key for getting it right for industry is how you present it, it's how you put together a workshop

KH Because a lot of the stuff you've done, I've probably delivered in a different way, but certainly the values and belief stuff I've done in leadership and management because understanding peoples personality to make changes to that personality means you have to understand what their values and beliefs are but you tend to do much more around explanation about what this and structured knowledge transfer as well

MB Right ok so there needs to be a bit more knowledge transfer

KH Maybe not before it but after, maybe do a debrief after the tasks, which I know you did but for us it's out of context and we don't know what came out of those discussions, and if there's so much value in that discussion afterwards how do they capture that value because you've got it recorded and you can write it up afterwards, what can they take away from those activities, I suppose that would be my question

MB Task 6 offered them the opportunity to reflect on what they got from the exercise but for industry you think they need to go away with something more

KH Something physical because ultimately if somebody sent a company representative on a workshop that's supposed to change attitudes for individuals they'd want them to be able to come back and share that knowledge

AS That was going to be another question, when you talk about industry, is it individuals or organisations, from my perspective I would pitch that at organisation level and I would probably do spider gram based on what the outputs are from the first one and then a spider diagram after to show the stretch in the different aspect of SD because then that's a real tangible thing that the organisation gets from the process

MB So did you think that the circles task was useful?

AA I have to say of all the tasks that was the one I probably got the least but then that's maybe about whether they

MB Well it fed into task five about starting to think about what they can and can't to and then thinking about that in terms of their professions

AS I use that principle quite a lot around the circle of influence and concern, if it's a concern they need to understand how can I influence and control it so that's what you're trying to do through that process, I use that quite a lot because people say well I can't do lean because of, and I'll say well actually guys that is a concern, the bit you can influence and controls will then start to impact on the concern

TW I like it I think it would work

AS So maybe tailor that more not as wider issues but to issues within their organisation AS

MB So almost blend it with that of task 5 but rather than ask them to write it down they use the circles to complete this task instead?

AS Yeah

AA I think it was more they were picked a bit at random but I understand what you're trying to do, elicit a response from them and get them to think about things

AS So if you did poverty for example what are your concerns about poverty and then as an organisation how can you influence that. You could either pitch it as a workshop which individuals from organisations come to or if you're trying to change culture and behaviour for me it's normally organisational in construction at the moment not individuals because the individual would just disappear in an organisation that hasn't heard that message so I would want to pitch it at an organisation.

KH I agree

AS You could go in and assess with the questionnaire as we said before and provide feedback on the current state of their organisation and then say well actually you need to go on change programme and the intervention you did is the starting point of that

TW I agree with you, I think ultimately that's what your trying to do, but its whether your approach is a bit like BIM champion we do, you take the individual as the change agent and you put them through this in order to be able to effect that change or do you design something that works at an organisation level, you'd still probably need that to get the right

AA For an organisation what you have there is baseline

MB So it's part of a wider programme

AA Oh without question you can't do it in one session, but it's a good test bed, that's what you've got, you've tested the approach and it worked but in terms of practical implementation and what you need to do its organisation change which doesn't happen in a short intervention

MB But there was some impact in that short time so it's worth pursuing

AA Oh definitely