Developing a Model for the Application of Post-occupancy Evaluation (POE) as a Facilities Performance Enhancement Tool in the Higher Education Sector

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The following has been excluded at the request of the university :

Figures 2.1 p.13 , 2.2 p.14 , Table 2.1 p.24 , Figures 2.4 p.48 , 2.5 p.51 , 2.6 p.52 , 2.7 p.53 and Table 2.4 p.54.

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Abstract

Post-occupancy evaluation provides a mechanism for systematically evaluating facilities performance. However, the effectiveness of existing models within HE is subject to question with few institutions fully embracing its application. The research sought to establish the extent to which POE models are utilised and the degree to which they satisfy the needs of HE in England and Wales. The outcome of the work was to propose a POE model that addresses the needs of Higher Education institutions. The research found that development of POE models has been driven by numerous factors resulting in creation of sophisticated POE frame-works. However the extent to which they are considered effective is limited. Earlier work focuses on the identification of factors that influence user satisfaction and development of complex quantitative models. Users of such models seek to learn lessons from projects to improve the design and delivery of facilities and enhance their performance in use. However, the extent to which existing POE models facilitate this is subject to question.

The study adopted a mixed methods approach to establish whether existing models reflected the factors influencing user satisfaction in the specific context of HE. It revealed that physical and internal environmental factors influenced user satisfaction in varying patterns with varying results in differing situations. The perception of quality consistently correlated with users' overall perceptions of satisfaction with buildings. The term 'quality' is a made up of several discrete factors; further work could be developed to allow these to be fully defined. The research concluded that a single POE model would be inappropriate and a frame-work is proposed based on a balanced scorecard, reflecting four performance dimensions tailored to the context of HE and allowing linkage of POE to strategic institutional plans.

The project liberated contribution to theoretical knowledge and professional practice. It established that within HE the concept of a consistent set of factors correlating with overall satisfaction is flawed. It went further to identify the construct of 'quality' as a key factor influencing satisfaction and established user satisfaction is a construct that is time related. It also found that application of POE is inconsistent across the HE sector in terms of purpose and extent of connectivity to institutional objectives.

These findings indicated that adoption of a standardised POE model within HE is unlikely to liberate consistent, useful data to enhance building and facilities performance. The adoption of the proposed approach offers a vehicle cost effective development of tailored POE solutions.

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List of Abbreviations & Acronyms

ADA	Art and Design Academy
AUDE	Association of University Directors of Estates
BCO	British Council for Offices
BIFM	British Institute of Facilities Management
BIU	Buildings in Use
BPE	Building Performance Evaluation
BPRU	Building Performance Research Unit
BQA	Building Quality Assessment
BRE	Building Research Establishment
BSC	Balanced Scorecard
BUS	Building Use Studies
CABE	Commission for Architecture and Built Environment
CIBSE	Chartered Institution of Building Services Engineers
CIC	Construction Industry Council
DQI	Design Quality Indicator
FM	Facilities Management
GIS	Geographical Information System
HEDQF	Higher Education Design Quality Forum
HEFCE	Higher Education Funding Council for England
HEI	Higher Education Institution
HVAC	Heating Ventilation and Air Conditioning
IEQ	Internal Environmental Quality
IM	Importance Index
LEED	Leadership in Energy and Environmental Design
LJMU	Liverpool John Moores University
LRC	Learning Resource centre
OLS	Overall Liking Score
PFI	Private Finance Initiative
PPG22	Planning Policy Guidance note 22
PROBE	Post-occupancy Review Of Buildings and their Engineering
RIBA	Royal Institute of British Architects
RICS	Royal Institution of Chartered Surveyors
SPSS	Statistical Package for Social Sciences
STM	Serviceability Tools and Methods
TM22	Technical Memorandum 22
TRB	Tom Reilly Building

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1.0 Introduction

1.1 Introduction and Background

The performance of buildings has been identified as a key factor in the overall performance of organisations in delivering their core business. The UK Higher Education sector has recognised this and over recent years considerable focus has been placed on evaluating and enhancing the performance of the physical estates of universities and colleges. As a result there have been numerous approaches to the evaluation of the performance of buildings and facilities, together with attempts to measure the extent to which they result in overall user satisfaction. Post-occupancy evaluation (POE) is a structured approach to the assessment of the performance of buildings and facilities. A wide range of evaluation techniques based around quantitative and qualitative models of POE has been developed although the degree to which they are considered effective is variable. There is also a body of opinion that questions the purpose and efficacy of POE in the context of overall organisation strategy. (Zimmerman and Martin 2001), Whilst POE has been established for many years within the UK and internationally it has been subject to varying levels of support. (Preiser, 1988) Although the role of POE as an effective tool for enhancing facilities performance has been generally recognised there has also been recognition that its effective implementation is inhibited by a series of barriers. There have also been differing viewpoints on the purpose of POE with some commentators viewing it as a method of gathering data to support design evolution, others seeing it as a method of evaluating project delivery and others perceiving it to be a tool for evolving building functionality in use. Most of the POE models in existence attempt to evaluate building performance in the context of the physical aspects of the building, the functional requirements of the specific use and the satisfaction of end users. However, the degree to which they are perceived to succeed in this and the extent to which they are valued by building designers and operators are subject to considerable question. (Turpin-Brooks and Viccars, 2006)

POE has been used within many contexts and across a variety of sectors including health, education and commercial buildings with varying degrees of success. The UK Higher Education sector has been the subject of many POE assessments and a specific approach to POE has been developed by the Association of University Directors of Estates, supported by the Higher Education Funding Council for England.

The rapidly changing environment of the UK Higher Education sector presents specific challenges in terms of the performance of facilities and buildings. (Andrew 2010) The complexity of their form and functional requirements, together with the potentially differing needs of various groups of end users result in the need to adopt well informed approaches to enhancing their performance. It has been posited that POE offers a valuable role in this process; however, previous research suggests that the level of adoption is inconsistent and the perceived efficacy of the process within the sector is subject to question. Despite the development of sector specific tools within the AUDE POE model relatively few Higher Education institutions adopt them and link them to overall institutional goals. There is also a degree of scepticism regarding the extent to which existing models accurately reflect and assess the factors that influence user satisfaction within buildings. As a result there are varying attitudes amongst designers and facilities operators regarding the extent to which POE can be considered as an effective tool to support the enhancement of facilities performance both in a general context and within the specific context of Higher Education institutions.

Previous research in this field has focused on identifying the physical factors that influence building performance and has resulted in the development of a range of extensive and sophisticated models for POE. However, there is evidence that such models are not widely utilised due to the perceived existence of a series of barriers including perceptions of complexity and cost. In addition there are differing views regarding the extent to which such factors accurately reflect the needs of the HE sector. Few studies have attempted to assess the efficacy of existing POE models and to consider the issues surrounding their lack of widespread utilisation. For this reason the study aims to identify the existing approaches to POE within the Higher Education sector, to review their efficacy and to identify mechanisms to support their use in a pragmatic and effective manner.

1.2 Aims

The aims of this research are to evaluate the effectiveness of existing POE models within the Higher Education sector in enhancing building and facilities performance, to establish the extent to which they assess the factors that influence user satisfaction and

to propose a revised model that addresses the needs of individual Higher Education institutions.

1.3 Objectives

The aim of the research will be addressed through the following objectives, which form the foundations of the proposed study:

1: To identify existing models of POE and the basis upon which they have been developed and applied

2: To establish the generic drivers and inhibitors for the application of POE and to compare and contrast these to the specific drivers and inhibitors in the context of HEIs.

3 To identify the nature of outcomes of POE applications in differing scenarios and contexts.

4: To identify the key desired outcomes of POE in the specific context of HEIs.

5: To gather and evaluate data in order to assess perceptions of the applicability and efficacy of different models of POE and to link and compare these to the application of the POE process for HEIs.

6: To propose a pragmatic model for the application of POE aimed at delivering the desired outcomes within the specific research context.

1.4 Overview of methodology

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

- The generic background and context of POE, its origins and evolution as a tool for assessing building performance and enhancing design.
- The various views of POE and its role within organisations
- The nature of building performance and the factors that are considered to influence users' perceptions of satisfaction with buildings and facilities
- Existing models of POE, the elements that they aim to evaluate and the degree to which they are considered effective.
- The specific context of building performance and POE within Higher Education facilities

The main findings of each stage of the literature review have been summarised and conflicts in the findings and lack of available literature were identified. The findings of the literature review were utilised to formulate the research questions that needed to be addressed through the project.

A further literature review was undertaken, focused on the potential research methodologies available to determine the most suitable methodology for the collection and analysis of data to address the research questions. Alternative methodologies were evaluated to ensure that the most suitable methods were utilised and on the basis of this evaluation a mixed methods approach was selected. The research framework was defined with three phases of data collection and analysis being formulated.

Firstly there was an initial pilot phase, which was intended to validate the proposed area of study as being a suitable research topic for PhD study. This phase incorporated the use of a simple questionnaire to undertake a landscaping exercise to assess the current extent of understanding and utilisation of POE within the English Higher Education sector. It also featured a series of preliminary interviews that were used to scope the main data collection phase of the project and to refine the questions to be used in later interviews.

The pilot phase was followed by the main data collection and analysis phase which employed both qualitative and quantitative elements of data collection through the application of questionnaires, interviews and focus groups. This phase also featured the participation of both HEI facilities operators and users.

The final phase, which was used to present and validate the proposed model based on the outcomes of the earlier sections of the work.

The details of the data collection and analysis undertaken within each phase are outlined briefly in the following sections and are discussed in more detail in the relevant chapters.

1.5 Hypothesis

Following the undertaking of an initial literature review and identification of the research problem the following hypothesis is put forward:

> *Existing models of POE have developed to become overly complex and costly in application. As a consequence the use of POE as a facilities performance enhancement tool is inhibited. Effective utilisations of POE as a performance enhancement tool within the HE sector requires the development of a pragmatic model derived from specific user requirements in the given context.*

1.6 Organisation of Thesis

This thesis is structured as follows:

Chapter 1 ***Introduction:*** this chapter provides an overview of the project and sets out the main aims and objectives together with a summary of the content and structure of the thesis.

Chapter 2: ***Review of POE in Higher Education***: this chapter sets out the main findings of the literature review within a series of broad themes. Firstly the background and context of POE are reviewed in a generic context with explanation of the purpose and bases of its application as a tool to enhance building design and performance in use. This is followed by a consideration of the main drivers and barriers to the adoption of the POE process that have been noted within existing literature, together with description of the various models that have been developed and adopted within the UK

and beyond. The principles of building performance assessment are discussed with the main components that are embedded within existing POE models described and explored. The chapter concludes with consideration of the specific issues surrounding facilities performance within Higher Education environments and the nature of POE applications within that specific context, reflecting on the extent to which existing models are employed. This chapter also identifies the areas for potential exploration within the project that could form the basis for original contribution to knowledge.

Chapter 3: Research Methodology and Conceptual Framework of the Research; this chapter discusses the various methodologies that could potentially be utilised within the project. It considers the options available for the collection of primary data and evaluates the advantages and disadvantages of the different approaches. A conceptual framework for the research project is presented with the methodologies adopted for each of the phases of the work described and justified. A brief overview is given of the method of implementation of the selected methodology together with the approaches taken in the analysis of the data collected within the qualitative and quantitative components of the work.

Chapter 4: Overview of current practice: Pilot Phase; the process of undertaking the pilot phase of the work is described, including the basis of selection of the research samples for the pilot element and for the wider project. The results of a landscaping exercise intended to gain a broad understanding of the extent of familiarity with POE and its use within English Higher Education institutions are presented. In addition the outcomes of a set of pilot interviews with selected Directors of Estates are considered and used to confirm the validity of the selected topic area as the basis of study for the PhD project. The results of the interviews are also used to refine and confirm the structure and content of semi-structured interviews to be applied within the main phase of the project.

Chapter 5: Analysis and Evaluation of the Application of POE in Higher Education Institutions; This chapter describes the main data collection and analysis phase of the project, which include a range of quantitative and qualitative research techniques. The results of semi-structured interviews with users of the POE process in HEIs are discussed and analysed in relation to their perceptions of the purpose of POE,

the drivers and barriers affecting its adoption and their opinions of the efficacy of existing models. Their perceptions of the key factors affecting the satisfaction of building users are also explored. In addition the results of quantitative, questionnaire based and qualitative, focus group based elements undertaken with building users are described in relation to attempting to identify the key factors affecting their perceptions of building performance. The results of the various elements of the data gathering and analysis are presented and interpreted in relation to the initial aims and objectives of the project.

Chapter 6: Discussion of Results and Proposition of POE Model; within this section the results of the foregoing sections are discussed in relation to the defined hypothesis, aims and objectives. The factors perceived as affecting users' satisfaction with buildings and facilities are discussed and compared, with reference to the initial literature review, the pilot phase and the main phase of the work. In addition the results relating to the perceived purpose of POE and its efficacy within HEIs are considered and a set of underlying principles for its effective application is presented, based on the main findings of the research. On the basis of the principles identified a balanced scorecard is proposed as a framework for the pragmatic application of POE. The validity of the proposed model is considered through the presentation of the results of a series of structured interviews with the same group of participants that were involved in the main data collection phase.

Chapter 7: Conclusions, Contributions and Direction for future work; in this chapter the final conclusions of the project are presented together with the limitations of the work and the potential future directions for the research. The key areas of original contribution are highlighted and their relevance to academic development and practice enhancement are described.

Figure 1.1 below illustrates the linkages between the conceptual basis of the work, through the aims and objectives, to the structure of the project and the assembly of the thesis.

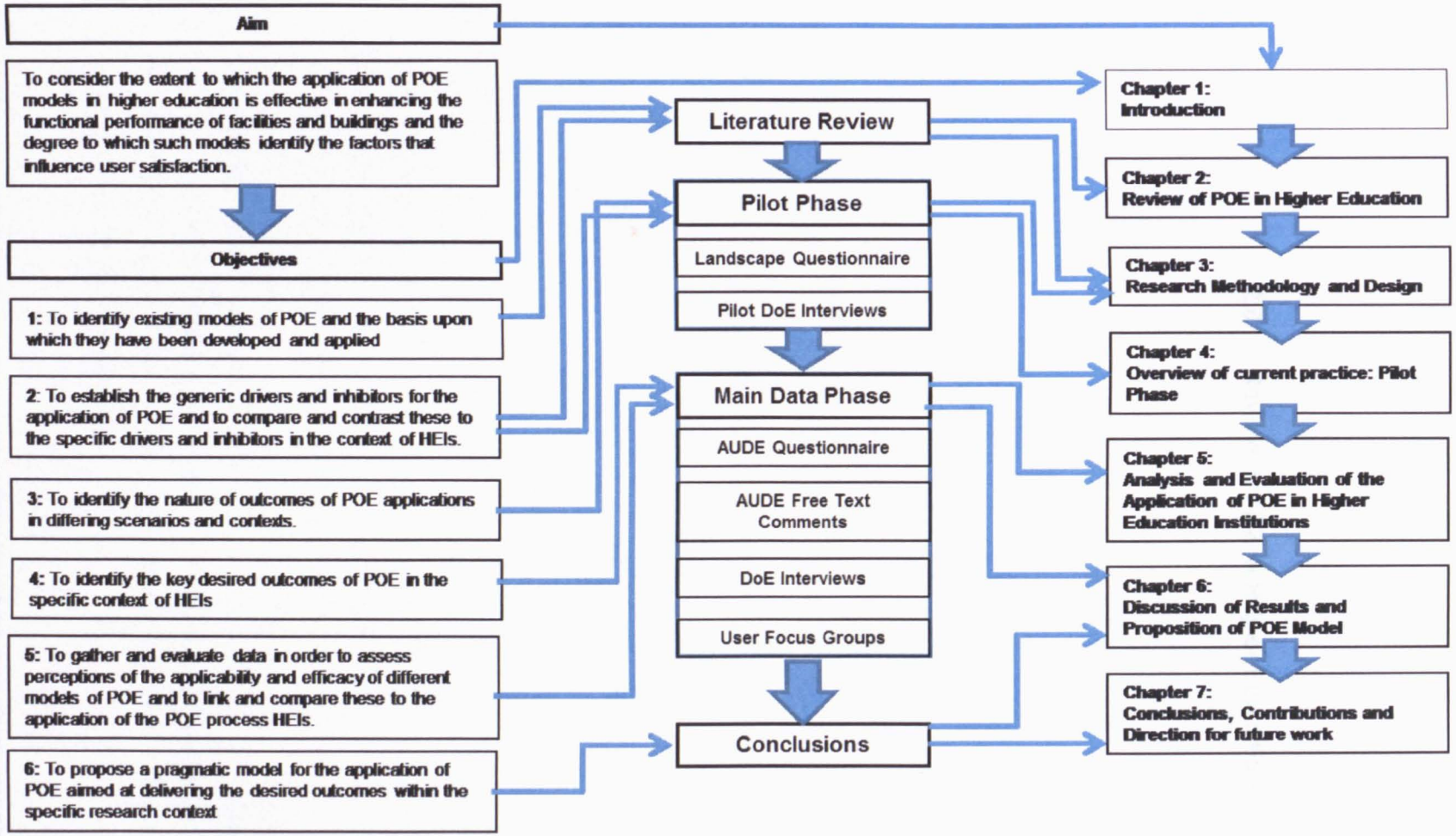

Figure 1.1: Concepts and linkages to thesis structure

2.0 Review of POE in Higher Education

2.1 Post Occupancy Evaluation

Post-occupancy evaluation (POE) is a well-established tool for the assessment and moderation of building performance. The basis of POE is the systematic review and evaluation of the performance of a building or facility following its occupation by users. It is generally accepted that building performance is associated with three broad aspects; firstly, the physical or technical nature of the building or space, secondly, the functional requirements of its specific use and thirdly, the behavioural aspects of the occupants. (Preiser W., 1988) Traditionally, the intended outcome of the POE process has been an attempt to moderate the physical environment to match perceived user needs or to provide a knowledge base for informing future designs. The historic approach to the process has been to apply it to newly constructed buildings shortly after occupation. However, in recent years POE has evolved into a tool for tailoring building performance around changing user needs in existing buildings (Riley M., Wordsworth P. et al 1995).

The benefits of post-occupancy evaluation (POE) to certain types of organisation are well documented and have gained general acceptance in the property professions. (Preiser W., 1995) (Riley M., 1996) The majority of users of formal POE processes have been large corporate organisations and public sector bodies of various types. It is possible that the reason for this may be linked to the origins of POE as a developmental tool for bodies involved in repetitive building programmes or occupancy profile changes. One of the primary drivers in this is the pace of advance in the development of Information Technology.(Graham T. 1995) Many of the large organisations that have commissioned POEs are strongly associated with IT. However, as IT has developed they have largely rejected the option of repetitive POE. (White T. 1992) Some of the reasons for this are explored within the following chapters.

White (1986) supports the view that what we understand as building performance lies at the overlap of physical building form or technology, user behaviour and functional need. He proposes a generic model of interaction that is illustrated in Figure 2.1 below. The principle of this model is widely reproduced.

Figure 2.1: Building performance at the overlap of behaviour, function and technology (White E. 1986)

Post-occupancy evaluation sits at the boundaries of technology and psychology. As a result much of the focus of building performance assessment within facilities management has related to environmental psychology and evaluating building performance based on human perception. This has developed as a key subject area within facilities management (Becker F. 1990; Belcher R. 1997) and is considered to be one of the primary underpinnings of the POE process (Hawkins H 1998).

POE has been applied to a variety of building types with varying levels of success (Preiser W. 1995). The majority of documented cases relate to commercial and educational buildings although there are also many examples, internationally, in the fields of housing and municipal buildings. The rationale behind POE is to consider the extent to which a building meets the needs of its end users, and also recognise ways in which design, performance and fitness for purpose can be improved. However, there are several different perspectives on what POE entails and when and how it should be applied. (Turpin-Brooks and Viccars, 2006)

Many technical evaluations are conducted within the construction and property industry including structural testing, mechanical systems performance checks and so forth. POE differs from these in that it addresses issues such as occupant performance, worker satisfaction and productivity as well as the evaluation of the physical aspects. (Preiser and Vischer (2005)). It is posited that POE is most valuable, as a tool, to those who are involved in continuous development of similar construction programmes or who have large estates which are to be remodelled (Preiser, 1995). The process involves a rigorous approach to the assessment of both the technological and anthropological elements of a building in use. It is a systematic process guided by research covering human needs, building performance and facilities management.

Zimmerman and Martin (2001) see POE as a logical conclusion to the design process, with the feedback loop providing a valuable platform for lessons to be learnt from occupiers. This unearths both how the existing space could be used more effectively, and provides information that could feed future design of similar buildings. This is supported by more recent work including that of Steinke et al (2010) who identified the importance of an effective feed forward process to allow the benefits of lessons learnt to be maximised within a healthcare environment as illustrated in Figure 2.2 below.

Figure 2.2: Traditional Feed-forward model of POE (Based on Steinke, C., et al 2010)

This view is supported by Cooper (2001) who argues that without there being a process in place to obtain feedback from a building's performance, having been constructed with new systems, in new ways with unknown outcomes, then it effectively remains a prototype. To fully understand if a building is truly effective, feedback needs to be sought from those using it. Without this feedback and evaluation taking place, clients are missing opportunities to;

- Discover if the building supports the needs of the occupying organisation
- Swiftly identify flaws in the building which can quickly be corrected
- Improve performance of building users, which in turn can impact on the organisations profitability
- Improve morale of staff, by acting upon their thoughts and opinions

(British Council for Offices, 2007)

There remains the view amongst some observers that the current approach of identifying and reacting to issue significantly hinders the degree to which learning from previous experiences is actually taking place. Improved integration between design and construction is essential through improved feedback if continuous improvement and learning from previous experiences/projects is to be achieved. (Henderson et al 2013)

The term Post Occupancy Evaluation itself can be misleading in that it suggests a process of evaluation of the building once completed and occupied, when in fact several commentators consider that the process should be conducted throughout the building delivery cycle. POE was once concerned principally with evaluating and assessing the performance of buildings based on user experiences, although this has now evolved to consider a more holistic, process-oriented evaluation (Preiser and Vischer, 2005). The consequence of this approach is that not only are the facilities evaluated, but there is also a consideration of the things which shape them in terms of social, political, organizational and economic forces. These differing approaches are reflected in the ways that the various professions view POE.

The Royal Institute of British Architects (RIBA) see POE as a systematic way of gathering invaluable information on the performance of their designs, which would allow

them to build on guidelines to achieve continuous improvement, (RIBA, 1991). From the perspective of facilities management, POE represents a diagnostic tool for evaluating the performance of a building once occupied (Preiser, 1995). However, there is also a view that it is about the evaluation of the delivery of a project and the performance of the design and procurement processes. In this there is the potential for confusing POE with what is more commonly referred to as post-project review. (Scottish Funding Council, 2007)

Hewitt et al (2005) the potential purposes and value of POE to include:

- Support for development of design guides
- Provision of information to the building industry
- Testing of new concepts
- Justification of major expenditure
- Education of decision makers to avoid repeating mistakes
- Improving building performance over time
- Accountability of designers and building operators for building performance
- Better communication among designers, clients, facilities managers and users.

2.1.1 Historic application and evolution of POE

The principles of evaluating the performance of buildings and the impact of this upon users and their satisfaction have been established for many years. Examples include the Burolandschaft office developments, undertaken by the Quickborner team in Germany, as early as the 1950s (de Dear et al, 1997). The term Post Occupancy Evaluation itself originates from the occupancy permit which was issued by building inspectors in the United States to confirm that a building was fit for occupancy once completed, (Bechtel, R. 1997). It has now gained more generic recognition as a process to systematically evaluate building performance in use.

The concept originated as the application of one–off case study evaluations during its introduction in the 1960s, later evolving into a cross-sectional evaluation in the 1970s and 1980s. It came to prominence in the early 1960s, originating within architectural

practice, and being incorporated within RIBA's first handbook (1965). The RIBA recognised that a lack of 'scientific exploration' existed into the successes and failures of construction projects. This led to the inclusion of the final stage of the RIBA's 'Plan of work', Part M: feedback. This evaluation stage was seen as the 'most cost effective way of improving service to future clients' (RIBA, 1965).

Despite this development, interest in POE within the plan was soon lost due to the associated fees, insurance, liability, and its failure to be seen as an architect's responsibility (Cooper, 2001). As a result, RIBA removed the Part M Stage of their plan of work, as it was reported that clients were not prepared to pay additional costs for the process, coupled with the fact that RIBA did not want to give the impression that this stage was compulsory (Preiser and Vischer, 2005). With the architectural profession failing to embrace the POE concept during the early years, it was academics that decided to develop the initiative further. The most prominent area of academic interest related to POE was environmental psychology, with an aim of widening the availability of scientific knowledge, (Cooper, 2001). In 2006 Stage M was reintroduced into the plan of works by the RIBA committee, as a result of changing industry perceptions and approaches to sustainability, (Bordass and Leaman, 2005). Despite its re-emergence, it is still rare that architects become involved in the feedback process.

The notion of POE was formed as a direct response to problems associated with buildings within the care industry, such as mental hospitals, nursing homes and correctional facilities. Preiser (1995) states that that the performance of both existing and new buildings within the sector was considered to be having an adverse impact upon the rehabilitation of residents / inmates. He goes further to outline the following specific issues which were identified as having a negative effect on the users:

- Health & safety problems
- Security problems
- Leakage
- Poor signage and way finding problems
- Poor air circulation and temperature control
- Handicapped accessibility problems (*sic*)
- Lack of storage
- Lack of privacy
- Hallway blockage

- Aesthetic problems
- Entry door problems with wind and accumulation of dirt
- Inadequacy of designing space for equipment (like copiers)
- Maintainability of glass surfaces (e.g. skywalks or inaccessible skylights)

Early adoption of POE was also prevalent within the residential environment, as a direct result of rapid housing developments following the Second World War. Preiser and Vischer (2005) claim that a significant amount of construction of urban renewal projects in North America and much of the new town construction in Western Europe produced vast amounts of housing without really considering the needs and lifestyles of the occupants they were developed for. This approach caused both social and architectural issues, leading to the need for a systematic evaluation of the buildings and how they were being used, (Vischer, 2001).

Since then, the POE approaches have evolved from case studies of standalone building projects, to structured studies of varied building forms with valid, cross functional results to benchmark against in the future, (National Research Council, 1987).

POE in the UK

A focus upon project evaluation within the UK emerged in the UK in the late 1960s. It was given academic attention at this time by the Building Performance Research Unit (BPRU) at the University of Strathclyde (who were sponsored by the RIBA), the Architects Journal and the Ministry of Public Building and Works. The arrangement was for the University to obtain feedback and publish results of teaching and design on building performance, (Preiser and Vischer, 2005). The results of this study were published at the time within the *Architects Journal* and *Building Performance*, and the results are still widely referred to today, (Markus *et al.* 1972). It was at the time of the publication of the study result that RIBA removed the Part M Stage of their plan of work as discussed earlier. Despite the break through, Markus *et al.* (1972) criticised the feedback and evaluation carried out by the University, as they felt the BPRU had a greater interest in research rather than actually developing practical plans with a thorough theoretical grounding. This was seen as a barrier to it becoming a mainstream process.

As a result of changes to the funding offered by the UK Government for building research, the concept of POE was again embraced in 1994. A team was put together known as PROBE (Post-occupancy Review of Buildings and their Engineering) which included representatives from Building Service publication, CIBSE, and other multi-skilled individuals. The objective was to publish POE's after three years on a selection of newly constructed buildings of technical interest, (Preiser and Vischer, 2005). From 1995 to 2002, the outcomes of twenty POE's were published alongside review papers and a special issue of Building Research and Information (2001).

Since its existence, it has been embraced more commonly outside of the United Kingdom, particularly within the USA, (Cooper, 2001). Despite a historic resistance to POE by construction professionals, interest has re-emerged in recent years, particularly with Government clients and public funded projects, with a focus on the outputs of a project as opposed to the inputs, (Bordass and Leaman, 2005). Its re-emergence within the UK has come mainly as a result of Government driven initiatives, such as *Rethinking Construction, (*Egan 1998); the Government's planning framework (including PPG22) as well as local level proposals in the form of Agenda 21, Cooper (2001). This has resulted in the development of dedicated POE models for areas such as healthcare and education.

It is thought that POE is beginning to be taken more seriously with many clients being more interested in improving their facilities and occupants performance. This is coupled with software advancement and the internet making the process faster with lower associated costs, (Bordass and Leaman, 2005).

The underlying justification for undertaking a detailed evaluation of facility performance may indeed be related more closely to the organisational agenda than to the absolute performance requirements of the building. It has been suggested that POE is a tool to allow managers to continually improve the quality and performance of facilities (White T. 1992). The term 'continually' used in this context suggests an ongoing process. The experience of POE in the main, however, has been very much on the basis of 'one off' evaluations.

2.1.2 Drivers and inhibitors of the POE process

Drivers of POE

Many drivers exist which justify the claims for the use of POE on a more regular basis. Whyte and Gann (2001) suggest a number of drivers for the cause, or benefits arising from the application of the process, which include:

- Applying design skills with greater effectiveness
- Improving the commissioning process
- Improving and adhering to user requirements
- Improving management procedures
- Offering valuable knowledge for guides and regulatory design processes
- Help in targeting refurbishment

The performance of buildings as assets has taken on greater importance in recent years and establishing accurate performance benchmarking is required. However, it will only be known if a building offers maximum benefit throughout its lifecycle if an evaluation and feedback process takes place on its performance. The data obtained through POE can present the client with data to enhance the productivity of the workforce using the facility, Cohen *et al.* (2000).

It is suggested that the use of POE is necessary if the construction industry is to develop in the future, as it provides a base of knowledge from completed projects drawing on lessons learnt (Zimmerman and Martin, 2001). For this reason they feel that despite a number of motives for its use, POE's primary benefit is its ability to bring together valuable information which supports continuous improvement. Given this, it is logical that POE forms a final step in the construction lifecycle to help improve existing buildings or help when programming for future projects. The information gained carries significant value for all stakeholders involved within the project lifecycle, with particular elements of the information being of benefit to different stakeholders for different reasons (Preiser, 1995, 2002).

The introduction of the Egan report (1998) has acted as a principal driver of POE. Having reported upon the lack of "*objective process for auditing client satisfaction*", the previously laissez faire approaches of the industry were condemned, and processes such as POE brought back into the mindset of the industry, (Cooper, 2001).

The number of benefits which can potentially be derived from POE, offer a number of incentives which drive its deployment for many building owners. Jaunzens *et al,,* (2002) offer the following motives behind its use;

- Staff time savings or improvements in efficiency through the provision of appropriate facilities (*e.g. local meeting spaces aid teamwork*),
- Staff reduction in discomfort, thereby reducing instances were staff feel physically affected in their work (*e.g. glare on computer screens, noise in the open plan, improved chairs*),
- Increased staff motivation (*e.g. provision of local coffee facilities, cold drinking water machines in response to staff requests*),
- An ability to prioritise facilities budgets more effectively (*e.g. knowing that lighting is the biggest concern to staff*),
- An ability to spot potential system inefficiencies (*e.g. inappropriate time clock setting, windows open and heating on*).

A driver for POE within any organisation could be considered generically under the label of quality enhancement. The definition of quality enhancement will almost certainly differ greatly from one organisation to another. Hence, this label is less than definitive. The definition of quality as 'fitness for purpose' has been posited on several occasions and has become generally accepted in certain contexts including that of Higher Education. (Hodgkinson, R. 1998) However, this broad reference to quality does not in itself represent a definable driver. Organisations that have commissioned POEs have been driven by a variety of more specifically defined elements to effect the evaluation process, the following sets out some of the more generally accepted:

Commercial or operational benefit: the link between the performance of the built environment, user satisfaction with that environment and productivity or service quality

is undeniable. However relatively few commercial organisations attempt to engineer a user-environment match.

Measuring value: the term value is defined in many different ways within differing contexts, It can be taken to mean cost, worth or significance and there may be an intention to undertake a comparative evaluation of various alternative facilities or to benchmark a single facility against sector norms. This is often a driver in the public sector, particularly as the degree of public accountability increases.

Public image: the process of evaluating the performance of facilities with an intention to enhance service quality is a positive aspect for organisations wishing to appear sensitive to the needs of those involved in delivering and receiving the service provided. In the same way that some organisations have recently set out to appear environmentally conscious, so the idea of a compassionate and caring service provider with an agenda to provide the best facilities possible is a commercially exploitable facet of the organisation's activities.

Private image: the intention to appear to be a caring organisation with empowerment of those within it to effect change in their own environment can have definite positive effects upon those whose opinion is sought as part of an evaluation process. The generation of a positive internal image can liberate results that are difficult to measure objectively.

Developments in Information Technology: advances in IT have changed the nature of the way in which we utilise buildings significantly. It is undoubtedly the case that this change will continue and that its pace will increase. As this occurs the very nature of the way in which we perceive buildings as places of business operation, service delivery and user interaction will evolve. POE may provide a tool for monitoring and effecting evolution in this aspect of facility operation. Changes in the need for and nature of space will affect the way in which users interact with the built environment. The concepts of remote working and virtual office environments are now commonly discussed in many corporate organisations.

Change in organisational strategy: changes in the nature of business or service provision have effects on the nature of building environments need to support them. The evolution of work and attendance profiles result in the need to reconsider the nature of building performance and the interaction of form, function and users.
(Preiser W., 1988) (Watson et al 1995)

Whilst the benefits of POE and the drivers behind its application are recognised there are also a number of factors that have been presented as perceived inhibitors of the application of the process.

Inhibitors of POE

Dainty *et al.,* (2006) cite the structure of the construction industry as being a significant inhibitor of POE, given that it is mainly made up of a series of one off projects carried out by a temporary project team. Vischer (2001) identifies broader issues which negatively impact upon the adoption of POE, targeting '*barriers of POE [as] cost, defending professional integrity, time and skills*'. Furthermore, disjointed incentives and benefits coupled with a lack of agreed measures make the process difficult to evolve, (Zimmerman and Martin, 2001). A resistance is also held by many of the project team, with a concern that the results of the POE would unearth results that deem the building ineffective.

The British Council for Offices (2007), within their '*Guide to Post-Occupancy Evaluation*', offer typical barriers to POE from the perspective of the occupier, design team and facilities managers, summarised in the table below:

Table 2.1: Perceived Barriers to POE (BCO 2007)

O'Neill and Duvall (2004) highlight the fact that many stakeholders see the process as being a one off evaluation and that this may be a significant barrier to its development. For it to be truly effective, they feel that it should be seen and used as a mechanism for continuous improvement, with the collection of information happening over a longer period of time.

Literature suggests that the most prominent inhibitors to POE development include its lack of ownership, cost associated with the delivery of the process and culture/education, together with a range of other issues.

Ownership

Despite all parties appreciating the benefits of the POE concept, a major issue related the process is 'who takes ownership?' Ownership tends to be deflected by professionals, with a reluctance to become liable for the associated costs. As the POE process plays no part in standard procurement procedures, there is little motivation for designers to go beyond what is asked of them.

It has been observed that the process has potential to expose areas of practice that could lead to liability claims. As such ownership is deflected from many industry professionals, who are not currently obliged to conduct the evaluation process as part

of current procurement processes and with the process having the potential to unearth liability claims. This is coupled with the culture of fear, blame and conflict which is seen to exist within building procurement, (Jaunzens *et al.,* 2003). Clients fear that by taking ownership, they could potentially expose negative results, which in turn could reduce the value of their asset. There is also a perception that the design team and other clients benefit from the process, (CRISP, 2000).

Unless POE is seen as a standard part of the procurement process, Zimmerman and Martin (2001) fear that the full benefits of the process will not be seen, particularly with reluctance to take ownership.

Cost

In an attempt to determine who is responsible for the POE process, Cooper (2001) presents two questions which need to be addressed; 'who is responsible for commissioning and paying for the evaluation?', and 'who is professionally responsible to carry them out?'. From the perspective of the client, unless benefits and value are assured, then a reluctance to pay for evaluation process will be manifest. From the perspective of the client, it is felt that any 'testing' associated with the building product to ensure that it is working effectively should have already been paid for. They feel that they have invested enough in procuring the building, and if the designer / developer get things right first time, they should not pay anything once it has been finished, (CRISP, 2000).

In the case of the developer, there may be a reluctance to take ownership as it can result in a reduced profit margin (Turpin-Brooks and Viccars, 2006). This is also echoed by the design team, who feel that the process presents them with a no win situation. Should the process reveal problems, they could end up having to take responsibility for the issue, and in extreme cases, face being sued, (CRISP, 2000).

Given that designers are almost never paid to revisit buildings to assess the impact of their design decisions, no incentive exists for continual improvement through the feedback process, (Zimmerman and Martin, 2001).

Cooper (2001) also fears that with the client and the designer being open to either benefits or harm from the feedback, as well as having no defined benefactor, neither side will want to fund the evaluation. There is also a concern about not only who covers the cost of carrying out the evaluation, but also who covers the cost associated with the findings, (Bordass *et al.* 2001). With the gamble existing for both the client and the designer to either benefit or be affected by the process, it adds to the reluctance to invest in it.

Cohen *et al.* (2001) also cite that with an element of distrust existing within the industry, there are major concerns attached to the impact of POE on professional indemnity insurance.

Were the procedures involved in POE made cheaper and less time consuming, Bordass and Leaman, (2005) feel that there would be a greater likelihood that POE would be incorporated into procurement and professional development processes on a regular basis. However, McDougall et al (2002) argue that there is an inherent reluctance to adopt POE because of the cost of its application and the passing the responsibility onto designers for evaluation of their own outputs.

Culture /Education

Cultural and educational issues present barriers to the use of POE. Many expect designers, builders and their project managers to have an in-depth knowledge of building performance, when in fact many are only trained and have experience to create and remodel buildings. Not only are they not trained in this area, they do not have an obligation (and are not paid) to carry out the process, (Bordass and Leaman, 2005).

The lack of regard for POE within the industry could be seen to be shaped to an extent by the fact that the concept was virtually removed from the architectural curriculum in the early 1990s, (Cooper, 2001). Despite a considered lack of focus from an architectural perspective, McLennan (2004), argues that within many construction and project management Masters courses, attention is being given to building performance

and POE is touched upon. In order for it to become effective, education in the concept is needed across the construction spectrum.

Zimmerman and Martin (2001), add that an *'ignorance is bliss'* mentality exists within the industry, which thwarts new methods that exist with the aim of working more efficiently. This is demonstrated by commercial building owners, who fear that processes such as POE could potentially extract shortcomings and negatives in the buildings performance, which could, in turn, lead to tenants being lost.

Turpin-Brooks and Viccars (2006) stress the need for collaborative working methods to be developed in order to truly see the benefits of POE. They feel this should be done by effectively assessing key business performance issues as opposed to areas that professionals are comfortable with.

Resistance can also come from the occupants of a building, who may feel that moving into a new working environment is disruptive enough, and would not want the disruption of the POE process adding to opportunity costs, (CRISP, 2000). Consideration needs to be given to the timing of such a process, as if disputes with the occupant staff already exist, this process will become ineffective, and could possibly create greater internal disorder.

Despite POE having clear benefits it could be said that having looked at methods available, they can be complex given their apparent lack of flexibility. Inhibitors could be reduced if models were available which were more pragmatic.

POE has also come under criticism from other fields, in particular from environmental psychology, led by David Canter (1984) in his article 'Beyond building utilisation'. As an environmental psychologist himself, Canter stated that POE had a trivial role to play having explored the notion of building 'utilisation', as it is cut off from the process it aims to inform.

Lack of awareness or understanding

Although the cost of buildings is normally the second largest cost to an organisation after its staff, there is still a lack of appreciation in some areas of the importance of efficient and effective building performance as an aspect of organisational strategy. This is compounded by the lack of detailed knowledge on the part of many facilities managers of the potential benefits of POE as a management tool. This is in part a consequence of the relative rarity of successful examples of the process.

Organisational inertia

The process of POE is essentially about change or evolution in an organisation. The commissioning of the process, therefore, relies on an acceptance within the organisation of a need to change and the demonstration of a willingness to do so. The management of change is an area to which this document is not directed. However, the difficulties of effecting change in the type of large organisation that could benefit from POE must not be underestimated.

Fear of the result

From the perspective of the organisation, there may be a reluctance to expose aspects of facility performance and user satisfaction that require potentially costly changes to building environments or work practices. Research undertaken by the author, although largely informal and anecdotal, suggests that this is a strong element at boardroom level in many organisations resisting the POE process.

Short termism

Despite the longevity of many large organisations and the long term occupancy of certain facilities there is still a trend to consider building environments in the short term rather than the long term. Learning organisations are comfortable with the idea of evolving organisational strategies. However, linking this to the evolution of the buildings that support them may be a step too far.

Cause and effect & Timescales

The nature of human-environment interaction is complex and the factors that influence change for better or worse are often idiosyncratic. Thus there is the perennial problem of linking action to reaction or establishing cause and effect. The moderation of one aspect of the building's performance may liberate a positive benefit in user satisfaction, but this could be equally affected by some external influence entirely outside the scope of the POE process or even the organisation as a whole. In addition the time lag involved in the enhancement of building performance through POE and in turn the recognition of a positive benefit to the operation of the organisation can be great, often months or even years after the initial POE. By this time many other factors may also have changed, thus raising questions about the validity of taking a set course of action based on observations at a static point in time within what is a dynamic system of organisational operation.

(Preiser, 1988) (Watson et al 1995) (Turpin-Brookes & Viccars 2006)

Figure 2.3 below illustrates the conflicting nature of the drivers and inhibitors that are recognised in the context of applying POE in the form of a simple force-field diagram

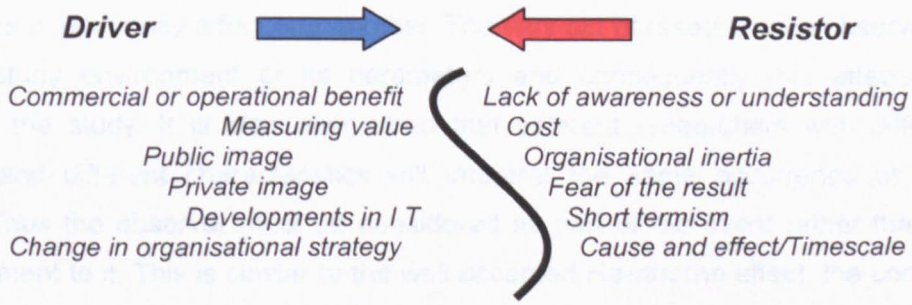

Figure 2.3: Drivers and resistors in the POE process

Validity issues in POE

The validity of the POE process has often been called into question, in part as a result of the resistors noted previously. In addition, however, there are some more generic questions regarding the process of user satisfaction appraisal and building functionality.(Churchman A. 1999)

The effect of undertaking user perception analysis as part of a POE is interesting. Through variety of case studies the positive benefit of soliciting user opinion has been illustrated. (Horgen T. 1996) Experience suggests that there is a clear positive impact in simply undertaking the process. (Revill D. 1995)

The application of POE within HE environments has become quite well established and has in some instances been deemed successful. However it has also been considered problematic due to lack of student engagement (Ramsden 2011)

The evaluation of building performance and observation of building/user interaction relies on a totally objective viewpoint being taken by the observer. In reality however, even the most objective observer comes to the process with an accumulated knowledge in the field. Whilst this may not go so far as to result in obvious prejudgement it has been posited that one cannot separate the researcher from that which they research. (Churchman A. 1999) They interact with each other and it is suggested as a result they affect one another. The very act of research and observation alters the study environment or its parameters and consequently this affects the outcome of the study. It is also maintained that different researchers with differing viewpoints and different characteristics will interpret the same occurrence or data differently. Thus the observer must be considered as part of the event rather than an external element to it. This is similar to the well accepted Hawthorne effect, the concept that the act of observation itself affects the actions of those being observed. The combination of these two elements, the observer being fashioned by their own experience and the observed being affected by the act of observation calls into question the validity of any observations made. In some instance this may not be a negative thing. If the agenda driving the process is one of corporate PR or the generation of a

'feel good' factor within the organisation it is perhaps the process itself that is important rather than the outcomes of it.

2.1.3 Existing POE Methods and varying user expectations

Various methods are available to effectively and accurately measure the performance a given building. There is no single defined approach to POE, and the methods selected should be decided upon based on the unique needs and objectives of those conducting the evaluation. Despite this, by using the principles of commonly used methods ensures meaningful results are obtained, which can be compared against previous studies of similar buildings.

According to Leaman (2003), who cited Bruhns, over 150 POE techniques are available worldwide, with 50 available within the UK, with effectiveness dependent upon the following:

- Giving results which are easily comparable with previous studies,
- The time and patience of respondents is not encroached upon too much,
- It offers value in terms of quality and content,
- It is relevant in a given situation,
- It is reliable by giving similar results when used by different people within similar circumstances, and
- It addresses factors which are related to the needs, activities and goals of the building users.

Preiser, (2002) and Leaman (2003)

A guide to POE developed by the Higher Education Funding Council for England (HEFCE) offers the following summary of established methods, and the associated techniques used for each.

Many construction professionals consider that POE is too time intensive and that there is difficulty in interpreting the information collected from POE. The perception that POE models are overly complex is widely held and this undermines the extent to which it is adopted and to which it is accepted as a valid approach. (Willams et al 2013) Table 2.2 sets out some of the main options available for POE together with a summary of their key attributes and perceived degree of complexity.

Method	Format / techniques used	Focus	How long does it take?	When is / can it be used?	Ref	Perceived Complexity
De Montfort method	- Forum - Walkthrough	Broadly covers the process review and functional performance	1 day generally	A year after occupation	www.architecture.com click on client forums	Low
CIC DQIs (Design Quality Indicators)	- Questionnaire	Covers functionality, building quality and impact	Questionnaire completion is online - takes about 20-30 minutes. Analysis is immediate	At design stage and after completion	www.dqi.org.uk	Medium
Overall Liking Score	- Questionnaire ; (Hardcopy/web based) - 7 point scale	Occupant survey. Sectors incl. educational Diagnostic tool	10 minutes for each occupant	About 12 months after occupation	www.absconsulting.uk.com	Medium
PROBE	- Questionnaire - Focus groups - Visual surveys - Energy assessment - Evaluation Performance of systems	User satisfaction / occupant survey - *Productivity* Systems performance Benchmarks developed	Overall process varies time needed 2 days (over two months) One-person month	Anytime but PROBE team recommend at earliest, 12 months	www.usablebuildings.co.uk	High
BUS Occupant survey	- Building walk -throughs - Questionnaire backed up by focus groups	Occupant satisfaction productivity	10-15 mins to complete questionnaire	On its own or in conjunction with other methods. Anytime but often after 12 months	www.usablebuildings.co.uk	Medium/High
Energy Assessment and Reporting Methodology	- Energy use survey - Data collection e.g. from energy bills	Energy use and potential savings	Full assessment up to one-person week	Once building is completed. On its own or in conjunction with other methods e.g. PROBE	www.cibse.org	Medium/High
Learning from experience	- Facilitated group discussions or interviews	Team learning from its experience	Ranges from single seminar to continuous evaluation	Can be used before, during and after project as 'Foresight, Insight and Hindsight' reviews.		Low
HEFCE/AUDE POE Toolkit	- Questionnaire - Focus groups - Visual surveys - Forum - Walkthrough	Process review and functional performance. Building quality and user satisfaction. Systems performance and benchmarking.	Varies from 1 day to continuous evaluation depending on extent and approach	Varies depending approach. Can be applied at design stage and after completion	http://www.aude.ac.uk/info-centre/goodpractice/AUDE_POE_guide	High

Table 2.2: Overview of POE models used in HE (adapted from AUDE 2006)

As can be seen by the table above, there are a number of existing POE methods available, which draw upon a number of techniques. The use of questionnaires to support quantitative approaches to analysis of data features heavily in the mainstream POE models that are established. These established methods can be adopted and amended were necessary and the potential exists to adopt entirely custom made approaches to POE in individual cases. The following are the most prevalent within current literature.

PROBE

PROBE (Post-Occupancy Review of Buildings and their Engineering) took the form of a research project, which was funded by the UK Government and The Builder Group, (publishers of the Building Services Journal). It ran from 1995 to 2002 with the results being made available to a wide audience. (Usable buildings website). During this time, PROBE published the results of twenty POEs together with a number of review papers, including a special issue of Building Research and Information (2001).

The aim of Probe was to gather results from previous POEs, and put them into the public domain to assist designers and clients to learn from them, as opposed to feeding the results back into the buildings occupiers. The approach by PROBE was significant, as it was the first in the UK to publish its results, and as a result it set out a precedent for future publications, (Cohen et al. 2001).

This technique to POE sought to gather both quantitative and qualitative feedback, and used tools such as –

- TM22 energy survey method (for quantitative results)
- Building Use Studies occupant survey
- Interviews, walkthrough observations, review of technical issues.

Although POE is criticized in many quarters for being a costly process, the Commission for Architecture and the Built Environment (CABE), assert that the PROBE studies have made the process affordable, and that it is of value to all involved. This is considered particularly so given that named buildings were published with valuable lessons learnt

placed in the public domain, (Sustainable Cities website, 2009). Since the completion of PROBE studies, similar studies have featured on the Usable Buildings Trust website, which demonstrates the effectiveness of the original work.

Priority issues that are commonly featured in POE models include both sustainability and energy performance, areas which were, until recently, thought to be traditionally neglected in the design process (Preiser, 2001).This is also noted by Frisk, (2001), who feels that studies carried out by PROBE fail to tackle all sustainability indicators and occupation styles during reviews.

The building Use Studies (BUS) Occupant Survey

Developed by 'Building Use Studies Ltd' alongside the 'Building Research Establishment (BRE), this method of benchmarking, based on a questionnaire survey, can be applied to a number of different building types. Developed in the UK, it has been in use for over twenty years and has a database of results available to compare results against other benchmarks. The questionnaire is applicable to buildings which are non-domestic, and with permanent occupants, for example offices, Higher Educational buildings and schools. A version of the questionnaire which considers domestic buildings has also been developed following successful piloting, (Usable Buildings website, 2009).

For this questionnaire a small set of Key Performance Indicators are used which can be compared against other buildings. It tries to unearth a compromise between the needs to the user, data management, analysis, validity in terms of statistics and question answering, Cohen, *et al.,* (2001).

Twelve topics are typically asked within this type of questionnaire, presented by Cohen *et al.* (2001) as covering such aspects as;

- Physical conditions within the environment (lighting, noise, air movement, quality and temperature)
- Personal control over the physical conditions

- Management response to complaints
- Health and overall comfort
- Background and the overall quality of the building

An issue which needs to be considered when contemplating using this method is that the questions are standardised, therefore not always relevant to a given building. This is so results can be compared to previous results gathered, Turpin-Brooks and Viccars, (2006). This is a natural disadvantage to the method, and effectively results in evaluating a building against somebody else's previously defined needs as opposed to those of current users or occupiers.

CIC DQIs (Design Quality Indicators)

The Construction Industry Council Design Quality Indictors (CIC DQIs) is a questionnaire used for POE, designed to suit a diverse range of people at almost any stage of the life cycle of a building. Developed by the University of Sussex alongside the Construction Industry Council, the nature of the questionnaire means that it can be used to gather feedback from anybody who is affected by the building, such as clients, occupiers, local residents, and even passers-by. It has been found to be relevant to the educational sector, most effective when carried out by the surveyor looking at a number of buildings so that it offers consistency in the evaluation process, (Collyer, 2005).

The self-completion questionnaire consists of approximately 100 questions, with answers selected from a six-point scale. The structure of the questionnaire is broken down into three main sections, in terms of;

- Functionality (in terms of use access and space),
- Build quality (in terms of performance, engineering systems, and construction),
- Impact (in terms of form and materials, internal environment, urban and social integration, character and inspiration).

(Usable Buildings website, 2009).

This feedback technique is usually carried out at the design stage, and after building completion.

A critique of this method is that it is thought to be too time consuming, and it impinges on staff time, (Turpin-Brooks and Viccars, 2006). The time-scale associated with the process also has a direct impact on the validity of the results obtained, as those offering feedback would tend to rush the process and will not give it the time it needs for true results to be obtained.

Overall Liking Score

The Overall Liking Score is used to obtain feedback from occupant regarding what they like about a building, aspects which they find successful, as well as any concerns they may have. ABS consulting, in collaboration with the University of Manchester Institute of Science and Technology (UMIST), developed the approach to address the three aspects of sustainable development, in terms of; economic, environmental and social. This is often referred to as the triple bottom line. The analytical approach can also measure Key Performance Indicators to assist maintenance and other facilities management services, (ABS consulting website). Over twenty five cases of OLS have been carried out within the UK, of which six have been within the educational sector as part of POE. The objective of these has been to support the institutes to make improvements through facilities management.

Higher Education Design Quality Forum (HEDQF) Post-occupancy Evaluation Methodology (AUDE/HEFCE Model)

The HEDQF is a joint venture between the RIBA and the Higher Education Funding Council for England (HEFCE) which was formed in 1995. The objective of the HEDQF is, specifically, to improve the performance of building and estates within universities and Higher Educational colleges. The objective of the forum is to provide long term discussions between those who procure educational buildings and the architectural professionals, meeting four times a year to assist continuous improvement.

The Association of University Directors of Estate (AUDE) undertook the development of a POE toolkit for Higher Education facilities in 2000 after the Higher Education Design Quality Forum (HEDQF) gave the Higher Education Funding Council for England (HEFCE) impetus to develop a contextualised POE review process. The aim of developing such a review was to enable the reporting on POE good practice for professionals and staff in Higher Education to use. This work produced the 'De Montfort' approach, which required the training of assessors in 2003. An important outcome from the AUDE/HEFCE/HEDQF initiative is to make the information from POE available to everyone. As a result the process of POE was to be promoted widely within the HE sector and the results of POEs disseminated or made available across the sector. (Henderson G., and Doidge C. 2000)

AUDE recognised that although there are various POE survey approaches in existence, the commonality between all of them is to be able to facilitate the development and operation of buildings in a more efficient way by taking into consideration the 'whole life' of the building as a part of the strategic management of the estate. This approach to POE identifies the need for developing synchronicity between the business aspirations of the institution as well as the ability and agility of the estate to support these. The AUDE POE proposition aspired to offer flexibility, with the potential for POE to be used as a bespoke, or tailor-made application or for an existing method to be used. Three levels of investigation are identified, which include:

- Indicative Review- a snapshot of the project, normally conducted by distributing a short survey to highlight the strengths and weaknesses of the building.
- Investigative Review- a more thorough investigation by where staff are asked to complete a survey which is then followed by a focus group or interview to gain a better understanding of the survey responses.
- Deeper Diagnostic Review- a very thorough analysis which links physical performance data to occupant responses.

The elements of investigation a POE can cover are:

- Process- this consists of two aspects which includes the delivery of the project from inception to handover and secondly assesses the operational management which is done by asking Estates how they manage the building
- Function Performance-is assessed as how well does the building support the institution's organisational goals and aspirations and also takes into account whether the needs of users are met.
- Technical Performance- includes the measurement of the performance of physical systems such as lighting, energy use, acoustics and ventilation)

AUDE has suggested three times when POE review periods should be applied to a building. These are to perform a(n):

1. Operational Review which is typically conducted 3-5 months after building handover.

2. Performance Review which is conducted 12-18 months after building handover

3. Strategic Review which is conducted 3-5 years after handover.

The main focus in an operational review is the process of delivering the project from inception to occupation of the building. It serves as an early evaluation of the building itself and helps identify any occupational and operational problems that require attention.

The project review is conducted after the building has had the chance to experience a full seasonal cycle (how does the building perform under different weather conditions). It allows for the identification of any chronic problems the building may have as well as allows for the cost of the use of the building to be calculated.

Finally, the Strategic review assesses how likely the building going to meet future needs and how have changes in needs been met thus far.
(Association of University Directors of Estates (AUDE) 2006)

The AUDE model is well regarded within the international design and FM communities and is seen as being well developed and grounded in theoretical research. It has formed the basis for the development of other models internationally such as the POE Programme and Policy for the Military Health System in the United States. (Battisto D et al 2012)

Soft Landings

Soft landings is a process which considers the lifecycle of the project, committing time and resources into briefing, pre-handover and the long term operation of the facility, (Sustainable Cities, 2009).

The Soft Landings Framework is published jointly by BSRIA and the Usable Building Trust and is intended to provide a basis for managed transition of buildings from construction to use. Projects undertaken using the frame work feature a series of interlinked stages that are intended bridge the potential schism between design, construction and occupation. These can be summarised as follows:

Stage 1: Inception and Briefing
Stage 2: Design Development
Stage 3: Pre-handover
Stage 4: Initial Aftercare
Stage 5: Extended Aftercare

(BSRIA 2012)

The soft landings concept seeks to ensure that designers and contractors are responsible for considering the whole life performance of buildings rather than simply their creation. It is intended that by 2016 the UK Government will require 'Government Soft Landings' (GSL) to be linked with Building Information Modelling (BIM) as a mandatory requirement for public building projects. GSL is intended to act as a 'golden thread' linking procurement, design, delivery and FM with POE featuring as an integral part of the entire process. (Rowland 2012)

Given this, it creates a route through to POE once the building has been constructed, usually after three years of being occupied. Rather than being a POE method, the process itself develops the relevant measures and an ethos for POE to be conducted soft landings had been introduced at the start of the project.

2.2 The Role of POE

2.2.1 Development of POE models and their application

Given the complexity of both buildings and the people that use them, the way in which they interrelate makes building performance potentially difficult to understand. Given this, it is vital that both are considered carefully when deciding an appropriate POE technique and model. While there are numerous tools and established approaches to POE available as outlined in section 1.4, it is the view of some observers that 'one size does not fit all'. Given this, by combining approaches to POE, it can enhance the understanding of a buildings performance, (Turpin-Brooks and Viccars, 2006).

Established methods v bespoke methods

When considering POE there are two primary options available, to adopt the use of an existing model which has been established and used previously, or consider a bespoke approach using a range of supporting data gathering techniques. In this context the term 'bespoke' is taken to mean tailor made for a specific instance. The following table has been developed by HEFCE/AUDE within their 'Guide to Post Occupancy Evaluation', offering both advantages and disadvantages to either creating your own POE method or using established models.

Existing Models	
Advantages	Disadvantages
Already tested Ready to use Backed up by rigorous research May offer benchmarking with other organisations in Higher Education sector Expertise available to administrator May be able to license use if method	May be a significant cost May not be suitable for specific situations Ownership of the data may not be yours Cost of experience to back up
Bespoke Methods	
Advantages	Disadvantages
Tailor to suit specific needs May cost less than established method Under your control	Time needed to set up Expertise needed May cost more than established methods

Table 2.3: advantages and disadvantages of existing and bespoke POE methods

Supporting techniques

The adoption of suitable techniques to support the POE process is dependent upon a number of factors, with the following presented by Jaunzens *et al.*, (2002):

- The level of detail required in any resulting report
- The level of information available to support an evaluation
- The amount of funding available balanced against the expected payback
- The skill levels of the people who will be undertaking the tasks
- The degree to which a problem has already been identified

The following are some of the most common techniques available that could be considered.

Survey / Questionnaire

The use of questionnaires is not only beneficial to collect data for the POE process, but it also encourages people to start thinking about issues related to the buildings performance. It could be said that the questionnaire acts as a catalyst for future steps in the process of evaluation (Horgen and Sheridan, 1996).

POE questionnaires typically consider key dimensions of a buildings performance, in terms of factors such as:

- Air quality
- Thermal control
- Spatial comfort
- Privacy
- Lighting comfort
- Noise control
- Building control

Distribution of questionnaires is generally through either a paper or web based survey. This can act as a sound mechanism for obtaining feedback from a large sample which can be easily analysed, particularly if results are quantitative. The questionnaire is also seen as the least intrusive and disruptive method of gathering information, as respondents can complete the survey in their own time (British Council for Offices, 2007). The principal advantage of this approach is thought to be the fact that a large sample can be targeted, which supports the reliability of the results obtained, (Capital development guidelines, 2009). It is recommended, as good practice, that when developing a questionnaire that it should be kept as simple as possible, and that pilot questionnaires are tested before investing significant amounts.

There are a number of established questionnaire based models already in use for POE, used across a number of industries. These are often used by others, and adapted to suit their needs.

Established questionnaire based POE models include;

- The Building Use Studies (BUS) Occupant Survey
- The Office Productivity Network (OPN) Survey
- Construction Industry Council Design Quality Indicators (DQIs)
- Healthcare Design Quality Assessment Method
- Overall Liking Score (OLS)
- Building In Use (BIU)
- BRE – relating to sick building syndrome
- AUDE PQE toolkit for Higher Education facilities (in part)

The principal mechanism by which these are analysed is through the use of quantitative analytical tools. However there are also several qualitative approaches to POE data gathering, some of which are described below.

Focus Groups / Workshops

Focus groups and workshops provide an arena for a sample to meet for in-depth discussion to extract feedback for the POE process. This method can be advantageous

in terms collecting information from a small number of building users in a short period of time. Conducting an open forum in this manner also allows participants to build on each other's opinions, and could also lead to arriving at a consensus. Conversely, this could potentially result in some participants being reluctant to share ideas in such an open arena.

However, depending on the nature of the organisation carrying out the POE, this method could prove to be inconvenient in bringing together groups of staff for a period of time.

When organisations are seeking to conduct mixed approaches for validity purposes, it is thought that interlinking focus groups and workshops with questionnaires works effectively, (British Council for Offices, 2007). This approach allows for quantitative feedback obtained through questionnaires to be investigated further, to unearth root causes to results and to also to provide a basis for gaining more qualitative results

A disadvantage to this method is that the process of analysing and comparing results can become time consuming and painstaking for staff.

Interviews

Structured and semi-structured interviews are seen as effective ways of collecting invaluable feedback directly from key staff/users. Structured interviews are considered most appropriate when the same information is sought from each of those being interviewed. This tends to take place with the interviewer basically administrating a questionnaire, often known as an 'interview schedule'. The semi structured interview is appropriate when a new area is being researched into, or when varying information is being sought from all interviewees.

In order for interviews to be meaningful, a flexible approach is required, but with a checklist of target issues predetermined to extract the most relevant issues.

The use of interviews during POE is particularly effective when investigating technical issues and issues which are potentially sensitive. It allows the interviewer to probe areas further, and remove ambiguity in questions being asked. However, lengths should be taken, to ensure that bias is not incorporated into the interview. A way of overcoming this issue would be to bring in an impartial third party in the same way that might be considered for focus groups. (Patton, M. Q. 1987)

Expert walkthrough / Observation

This method sees either the person conducting the POE, design team members or facilities managers evaluating the building through observation, and feeding back on issues which may validate or explain results gathered from other POE methods.

As well as giving informal feedback, the building can also be rated against a questionnaire or a scoring matrix, and linked directly to other POE techniques.

This method is sometimes seen to be favourable given that few staff resources are needed, reducing inconvenience. It can also gather both qualitative and quantitative results if approached properly, HEFCE (2006). However, the methodology may need meticulous application, for instance observing at different periods of the working day. Unless a methodology is developed and kept to, comparisons can also be difficult to obtain.

Finch (1999) encourages observation as a technique for POE, through '*empathetic design*'. This sees direct expert observation of building users, and feeding back through a report incorporating their innate understanding of building usage.

Whitemyer (2006) reinforced this view within his article '*Anthropology in design*', stating that observation offers a more accurate account of how people act within their given environments. Such observation not only discovers activities that are carried out, but also what additional interactions take place at the same time.

However, despite the advantages to the observation technique, a disadvantage could be thought to be that it does not offer any quantifiable results.

As a result of a study which was conducted by Turpin-Brooks and Viccars (2006), they suggested that ethnographic approaches lend themselves more to the educational sector, providing more practical solutions to related issues.

Considerations to be made

It is considered that greater accuracy is gained when combining a number of techniques within a chosen POE method. This allows feedback to be gained during one, and explored further during another. With this in mind, Jaunzens *et al.*, (2002) feel that when considering supporting techniques, it is essential that;

- It is holistic, looking at the relationship between the physical environment, provision of facilities and organisational attitudes
- Both cause and effect of issues is explored
- The results are verified subjectively, through either objective measurements or through balanced subjective opinions from a broad range of stakeholders
- All parties are included, assessing perceptions against reality
- The methodology is transparent so that results can be interpreted with assurance, limitations can be understood, and can be repeated if benchmarking and tracking is to be carried out over a period of time

Each organisation will approach POE differently, dependent upon their objectives and the availability of both time and resources. Considering these factors, Langston and Ding (2001) offer a breakdown in terms of the level of effort an organisation allocates to the process, categorised as *indicative*, *investigative* and *diagnostic*. These levels of effort are illustrated in figure 2.4 below, together with the additional element of project review that is considered by some parties to be a key part of POE.

Figure 2.4: Categories of POE (adapted from Langston and Ding 2001 & Turpin-Brookes, Viccars 2006)

Given that there is an array of different techniques and approaches available, with advocates for each, the US Federal Facilities Council (2002) set about standardizing the POE process into one preferred methodology. Despite their attempts, Bordass and Leaman (2005) suggest that this objective was impossible to achieve given that POE needs to consider individual circumstances, the needs of a specific project, resources available as well as cultural issues. In response, Bordass and Leaman (2005) presented a portfolio of techniques, with the content used when and where appropriate. POEs were divided up into the following five categories;

Audit - Approached using quantitative data gathering techniques such as the CIBSE TM22 energy assessment and reporting methodology.

Discussion - Approached using workshops and interviews to gain foresight (what they are about to do), insight (what they are doing) and hindsight (what they have done).

Questionnaire - Using developed POE questionnaire techniques such as the BUS occupant survey, the CIC design quality indicators (Whyte and Gann, 2003) and the overall liking score (Leaman, 2003).

Process - This is concerned with techniques that are adopted to shape the procurement process to derive feedback in a structured way. Techniques used are such approaches as Soft Landings, and the Building Research Establishment checklist.

Packages - This approach would see a combination of techniques in a structured manner, using established methods such as Probe and Workware package.

Green and Moss (1998), also provide the following three general processes to be considered;

- Planning: establishing scope, purpose and resources for study
- Execution (collection of data, interviews, questionnaires and direct observation), and
- Analysis and presentation (statistical analysis, technical performance, dissemination in a series of workshops and reports)

Following a review of techniques carried by Bordass and Leaman (2005), it was found that;

- Occupant surveys are widely used
- Energy audits are often conducted
- Facilitated discussions between project team members are less widely held, and
- Methods such as Soft Landings, which operate over the whole of the procurement cycle and on into aftercare are rarely adopted in a commercial building.

Despite the many methods presented within literature, there is minimal feedback data in the public domain that reflects on the effectiveness of each. The only exception to this is the results available from Probe, (Jaunzens *et al.*, 2002). This is ironic given that the concept of POE is concerned with continuous improvement through providing feedback from buildings, although a significant feedback loop is missing when it comes to reviewing particular methods of POE.

Despite the plethora of existing POE tools available new or alternative approaches to assessing facilities performance are constantly being considered. Some of these focus upon the specifics of individual settings or contexts, whilst others seek to establish broader frameworks for the strategic application of POE.

Alternative frameworks

Hasanain (2012) developed a four phase framework for the evaluation of architectural design studios that provides an indication of the major successes and failures in performance. The framework focused on the technical and functional performance of the facilities and is illustrated in figure 2.5. The technical performance requirements are derived from Preiser et al's (1988) definition as being *" the background environment for carrying out activities".* This was interpreted to include visual comfort, thermal comfort, acoustic comfort, indoor air quality and fire safety. The functional performance requirements are also derived from Preiser et al's (1988) definition as being those that deal with the fit between the building and the users' activities, enabling occupants to operate efficiently. This was interpreted to include cubicle quality and layout, interior finishes, brainstorming/project space and support services. The establishment and definition of these performance requirements is the first stage of the Hasanain framework and it is significant in relation to the foregoing research in that it represents the potential for the creation of a tailor made model for each application of POE. Whilst the framework was developed in the specific context of architectural design studios its principles are transportable to other contexts. Thus, the first phase is based upon the development of a contextualised and potentially unique set of performance requirements to be evaluated. There remains the question of how the definition of these requirements is informed, however.

The second phase is based upon a walkthrough inspection, undertaken by trained assessors, aimed at identifying the major technical and functional issues that may need to be addressed. The suggestion is that the assessment team composition would depend on the configuration and the scale of the facility and the exact nature of the outputs required. The walkthrough inspection would then be followed by a questionnaire survey to obtain the users' perceived level of satisfaction with various technical and functional performance requirements in the architectural design studio facility. The

questionnaire survey is intended to be prepared on the basis of the findings of the walkthrough inspection and a literature review. Hassanain identified a total of 33 technical and functional performance elements of performance for potential inclusion, assessed by respondents using evaluation terms used ranging from "Strongly Satisfied" to "Strongly Dissatisfied". It is asserted that the use of four-point rating scale that has no neutral midpoint compels respondents to display a definitive positive or negative assessment performance. (Preiser et al., 1988). It is also intended that a facility for free expression of user commentary is provided within the questionnaire the results of which would be analysed qualitatively. The final element of the second phase would be the undertaking of Interviews with the users of the studio space. To gauge their perceptions for each of the identified performance requirements and the quality of the facility.

The third phase of the suggested framework is the detailed analysis and interpretation of data using a range of qualitative and quantitative techniques. This would be followed by the fourth phase, which is the development of a plan of corrective actions that may range from immediate solutions to problems to longer term interventions that change the nature of the facilities and infrastructure.

Figure 2.5: Four Phase Framework for Assessing Design Studio Performance. Adapted from Hassanain (2012)

In the broader context of overall FM performance Amaratunga and Baldry (2000) have presented the use of a balanced scorecard approach based upon the earlier work of Kaplan and Norton (1996) as a framework for delivering strategic goals.

Figure 2.6: Balanced scorecard (Amaratunga and Baldry 2000)

Steinke et al (2010) developed upon the work of Amaratunga & Baldry to propose the use of a balanced scorecard, directed specifically at building performance evaluation (BPE) in healthcare facilities. This is referred to as the BPE scorecard and encompasses four performance dimensions as follows:

- Service: How can facilities enhance client experience in Healthcare?
- Functional: How can facilities enhance the quality of the work environment?
- Physical: How can facilities achieve and exceed current building standards?
- Financial: How can facilities add value financially and improve operational efficiency?

Figure 2.7: Building Performance Balanced Scorecard (Steinke, C et al 2010)

The performance dimensions of the Building Performance Scorecard map, to a degree, on to the performance factors that traditional POE models seek to evaluate. However, the wider concepts of facilities performance were noted to be absent from most of the existing models. There is, however, recognition that organisations are seeking to place the physical performance of buildings and facilities in to a broader organisational performance context. As such the balanced scorecard approach offers organisations dealing with physical estate facilities to extend POE to not only identify and evaluate occupiers' needs and preferences regarding the physical and social factors but also operational and financial elements. (Niemi, Lindholm, (2010)

The work of Steinke et al (2010) reviewed 16 different POE models and concluded that the majority of existing approaches assessed building performance across only 2 dimensions. Only one existing model, developed by Shiem-Shen Then (2005) assessed performance across all four dimensions identified within the BSC approach. This suggests that the majority of POE models are unlikely to successfully evaluate the full spectrum of facilities performance factors required by organisations. The methodology that was proposed by Steinke et al (2010) was aimed specifically at public sector

healthcare facilities and involves a 10 stage approach that evolves through the design, delivery and use of a building or facility as follows:

Table 2.4: Stages of building performance evaluation (BPE) model (Steinke, C et al 2010)

The output of the BPE model is a simple 4 page report that highlights the key issues arising from the evaluation. This approach attempts to reduce costs and complexity whilst ensuring focus on the specific context of the facility being evaluated. This approach to the assessment of building performance aligns partially with the components of existing POE models such as the AUDE POE toolkit, which was developed specifically for use by HEIs. (AUDE 2006) Figure 2.8 below illustrates the

conceptual linkages between the BSC developed by Steinke et al (2010) and the AUDE model developed by HEFCE (AUDE 2010)

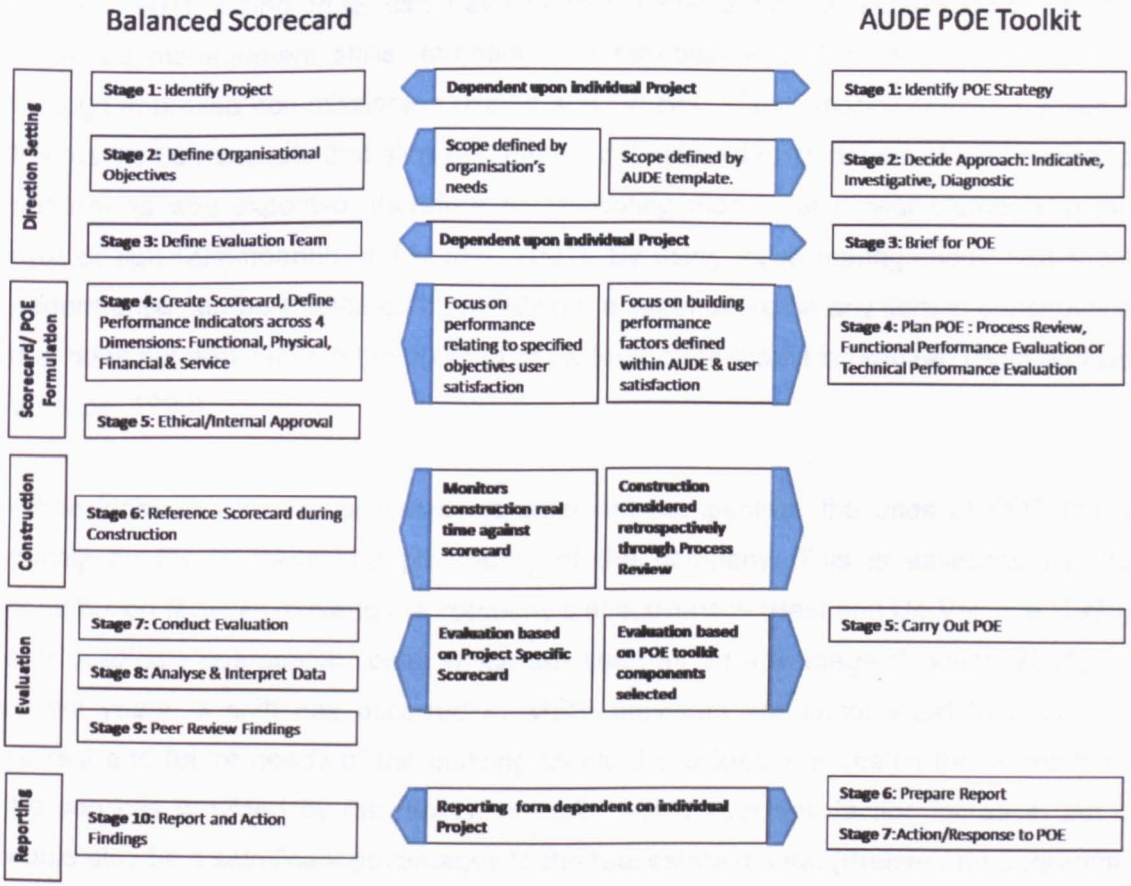

Figure 2.8: Comparison of Building Performance Balanced Scorecard with AUDE POE Toolkit

2.2.2 Strategic application of POE

Buildings and facilities represent a noteworthy asset to organisations at around 32-44% of their value. These large structures can also have a large impact on business productivity and success, therefore understanding how buildings manage this is of key importance (Best and De Valence, 1999). Therefore, organisations continuously engage in finding ways to provide their staff with effective work environments through greater involvement in the design process to ensure that appropriate performance requirements will be attained (Green and Moss, 1998).

Organisations have the opportunity to gain competitive advantage over other firms by conducting POE by seeing where maximum utilization and improvement opportunities lie within the building by using the yielded results to add value to it (Zimmerman and Martin, 2001). Using POE can have various benefits for the stakeholders through improved management skills, targeting and refurbishment. Clients can also benefit through improved commissioning (Hadjri and Crozier, 2009); money could be saved if the results demonstrate that allocated money did not lead to an aspect of the building to perform as was expected, therefore not allocating money for similar elements in the next design (Zimmerman and Martin, 2001). By using value management, redundant performance can be eliminated by avoiding the expenditure on any item in construction that does not add value to the building or perform more than it is required (Best and De Valence, 1999).

When looked at from a business management perspective, the uses of POE focus mainly on the success and profitability of the company. This is assessed by the contribution facilities make to the company's effectiveness (Best and De Valence, 1999) and building's operational costs, which are seen as an advantage (Cooper, 2001). In recent years, a shift has occurred in which providers are encouraged to know the current and future needs of the building users. If providers can match these needs to the services provided by the facility, not only would user satisfaction increase, but it would also be a significant advantages to the real estate market (Preiser and Schramm, 2002).

The employees of a business can be consulted on ways of improving the building. Not only does this enable management to actively improve operational performance, it represents good management practice, which will strategically result in the employees to feel valued and feel compelled to indicate where facilities could be upgraded or repaired (Best and De Valence, 1999).

Within the specific context of Higher Education facilities there has been recognition that like commercial organisations they need to constantly review and enhance the performance of their estates. The expansion of the HE sector from the early nineties, which continues today drives universities and colleges to make more efficient use of existing facilities and to create new ones that are fit for purpose. (Clarke, 1997). In

addition the specific role played by the built estate in supporting provision of study spaces of good quality has been identified along with the technological elements that both support it and drive change within it (Belcher, 1997). POE can support these strategic elements within HEIs by providing effective mechanisms for assessing and evaluating performance.

Figure 2.9 below, which is adapted from the AUDE Guide to Good Practice for Estates Strategy Development (AUDE 2013), illustrates the desired positioning of performance evaluation within a wider HEI strategic framework. Any effective POE model must sit within such a framework to allow its strategic impact to be maximised. One of the key elements illustrated within this framework is the linkage between core business drivers or institutional plans and strategies and the estates strategy. Here the process of evaluation is featured as a mechanism for enabling the effective delivery of the core strategic plans rather than being simply an abstract evaluation of building or facilities performance.

Figure 2.9: AUDE Good practice (2013)

Cooper (2001) suggested ways in which POE could be used to measure the progress of a building by conducting an evaluation at a specific point in time to measure resource consumption, and longitudinally through the building's life cycle to recognize when services or mechanisms need to be replaced or up-dated to improve the performance of the building and to extend its occupancy.

The notion of using POE as a design tool appears attractive especially during the 'pre-project' stage as organisations are unenthusiastic about evaluating a building **after** it has been built, even though it would reflect good practice; also, the knowledge gained from a previous building (even if it was not successful) can be used to design future facilities more adequately. This is referred to as 'reverse briefing' as the state of the last facility becomes the starting point for the next facility the client is interested in procuring (Cooper, 2001). A cyclical nature in the design process has been suggested as the commonsensical way of building procurement from which circles of improvement for the design of buildings can emerge (Hadjri and Crozier, 2009). From this, a dynamic and continually increasing knowledge base can be accumulated to allow for improvements to occur while a project is still on-going.

The results from POE determine whether or not the expectations of the occupants were met; additionally, the same results can be used to amend building deficiencies along with being referenced in future designs. Designers could profit from being involved or conducting POEs as the knowledge gained of the performance of a previous building can ease and ultimately improve the design of the next one, thus adding a competitive edge over other designers who are not involved in POE (Zimmerman and Martin, 2001). Within the scope of HEIs the process allows lessons to be learned from previous experience, whilst at the same time assessing current trends in the use and performance of facilities. (Avis, 1995).

2.2.3 'Ownership' of the POE process in organisations

Although there are normally three central groups involved in POEs which are the initiators, facilitators and the stakeholders, it is normally an organization's management personnel who initiate the process (Best and De Valence, 1999) of POE.

Best and De Valence (1999) posit that designers should not be blamed for substandard POE studies; the responsibility should be taken by the clients who do not cover the cost of POE in their design fees. McDougall, Kelly, Hinks and Bititci (2002) argue that if the construction industry thought of their buildings as products and to receive feedback on the products which they make, it would lead to the industry assuming ownership of the POE process. However, Roberts (2001) pointed out that it is as though the construction industry assumes that the responsibility of conducting POEs lies with the client. This raises the question as to whether the client is fully aware of best practice with regards to building procurement, or whether the construction industry should make the client aware that additional services could be included in the entire process; at a suitable price.

Zimmerman and Martin (2001) note that building owners have the greatest amount of authority because any remuneration acquired by using the information that emerged from POE will affect them directly. Not only that, but the owners can easily undertake operations which would improve the existing building, or to demand such design elements in the next venture. They also suggest that governments, by being prominent owners and occupiers of their own buildings, should lead the way in making POE a standard process and publish their results.

McDougall *et al,* (2002) go on to suggest that with the correct assessment tools, facilities management teams might be able to conduct POEs internally as they have access to "a deeper knowledge base" (p. 151) through extended case studies.

There is a growing frustration amongst construction professionals and facilities operators with the degree to which POE is still failing to become a mainstream activity in the building procurement process. Issues that are seen to contribute to this include POE's exclusion from professional curricula; issues around who pays for POE and issues with professional liability. (Hadjri, Crozier 2009)

2.3 Building Performance:

The foregoing sections have attempted to explain the concepts behind POE and have established that it is a recognised tool for the assessment of building performance. To gain a full appreciation of POE in this context it is also necessary to consider the nature of building performance itself. To put building performance in a historical context in relation to the development of the POE process, the first attempt to measure performance in the UK was conducted in Glasgow by the Building Research Unit in the late 1960s to early 1970s. The initial work took place in secondary schools in which a team consisting of an operational research scientist, quantity surveyor, physicist, systems analyst, an architect as well as a psychologist rated the schools on cost, the use of computers in design, user satisfaction, organisational requirements, spatial elements and environmental performance (McDougall *et al.*, 2002). The approach taken in these studies used questionnaires which aimed to establish circulation of pupils, the development of causal measures to identify relationships, descriptive scales and mapping as well as teacher preferences for accommodation.

Building performance measurement, like POE, has had shifts in perspective, most recently with the incorporation of the less technically focused management-approach. Issues can be looked at and resolved in new ways, thus broadening the scope of definition for it (McDougall *et al.*, 2002). Not only has the definition been broadened, but also the areas in which POE tools can be used. They are now considered appropriate for the evaluation of the performance of a range of buildings including schools, office buildings, health care facilities, as well as low-income and market-value housing (Ornstein and Ono, 2010). However, Amaratunga and Baldry (2000) cite Zimring et al. (1995) and Preiser (1994), referring to the slow uptake of systematic performance evaluation in HEI estates when compared to other, commercial sectors. This has been identified as an area worthy of further consideration.

As building performance measurement and POE originated roughly around the same time, the techniques of both methods have evolved and grown hand-in-hand to provide a more comprehensive assessment of buildings, yet ironically both methods are not used often enough due to the organisational culture which exists within the industry.

In an organisational context, costs and particularly ways of reducing them are of great importance. Therefore the benefits POE can have on assessing and even improving building performance come through determining if the building has any defects, whether performance measures for asset and facilities management are supported or whether life cycle costs can be lowered by identifying design errors (Khalil and Nawawi, 2009). Benchmarking such costs, and seeing how they are assessed with long-term end user satisfaction in mind, may shed light into what aspects of the building are worth investing in to enhance performance and which add very little to the overall building. It is at this stage when POE feedback is included (McDougall *et al.,* 2002).

2.3.1 Defining building performance

The degree to which facilities can support or be altered to support the changing needs of an organisation, and contribute to the organisational effectiveness are some of the criteria which encompass the quality of building performance. Facilities have to accommodate requirements such as equipment, places, spaces, comfort, convenience, profitability and people in order for its true performance to be evaluated (Williams, 2003). Building performance can therefore be defined as the contribution that the building or estate makes to the functional and financial requirements of the occupiers, owners as well as the physical behaviour of the services, finishes and fabrics over time (Williams, 2003). Building performance is coupled with the quality of the building mainly in terms of its durability, structural integrity, revenue costs and associated capital. However, it has been noted that building owners and managers associate performance with market value and profits as opposed to the functionality of the building (Best and De Valence, 1999; Williams, 2003).

Building performance measurement may serve as the tool which facilitates the owners and occupants of the building to express their needs and for the designers and facility managers to cater to these needs (Pati, Park, Augenbroe, 2009). As a result, building performance is crucial in the articulation of expectations by occupants and the fulfilment of these by the designers and building teams (Augenbroe and Park, 2005). One of the key components of POE is to research the level of satisfaction users have about the building. However, Vischer (2009) posits that measuring user satisfaction has become

an inherent weakness within the POE process. It is one thing to ask building occupants what they like and dislike about the building, but in order for a robust method to assess the performance of the building a refinement in valid criteria needs to be introduced. Therefore the subjective experience of users has been broadened out to include elements such as sense of community, functional comfort and task support, for example (Vischer, 2009). This has the potential to increase the perceived complexity of the POE process.To tackle this, Vischer offered evidence-based design which requires that design decisions are to be based on research results; requiring designers to justify their creations on more than just creativity and vision. Therefore, the way a building's performance is evaluated after it has been occupied can be used to prescribe appropriate amendments to similar buildings which have not yet been built through pre-design evaluation (Ornstein, Ono, Lopes *et al.*, 2009).

Khalil and Nawawi (2009) conducted a POE inspection survey on eight government and public buildings in Malaysia. The building performance measurement was based on a POE guideline which scores the building elements, environment and services on a 10-point scale denoting poor, medium and good performance. Their results indicated that most of these buildings performed well, to ensure that these scores reflected the true state of the building, users were asked about their satisfaction with the buildings and these scores correlated. After this, it was concluded that POE is a valuable approach to analysing the performance of government and public buildings in Malaysia. To this the researchers also added that the key to successful POE implementation is in the design and planning phases of procurement.

In the mental health sector, the conditions for the occupiers needs to be assessed from various perspectives in order to ensure that patients, staff and visitors are able to make the most of the services the building offers. Orstein *et al.* (2009) evaluated the performance of a psychiatric hospital in Brazil as it was being refurbished to ensure that a more pleasant environment would emerge which would in turn promote well-being and health among its users. This research used various tools in order to gain a better perspective of the various groups of users by conducting walkthroughs, interviews with stakeholders, focus groups and behavioural maps. In their concluding remarks, the researchers stated that not only was POE essential in the improvement of mental

hospitals, but that the implementation of pre-design evaluation was also important so that adequate time is spent in the planning process.

2.3.2 Qualitative and quantitative assessment of building performance

Traditionally, performance-based building approaches describe and assess the functionality of a building, its serviceability and the compliance or the buildings attributes and features with the users' requirements (Lützkendorf and Lorenz, 2006). Performance-based statement methods are thus needed to implement reasonable management of a "transparent process" to ensure requirements are fulfilled (Augenbroe and Park, 2005; p, 159). Such statements cannot come to existence without the same kind of work or principles used in similar buildings elsewhere.

POE aims to recognise the behavioural factors associated with the building-user interaction and seeks to measure performance by assessing facilities in three crucial areas:

- Physical performance- which is related to how the structure behaves with the services provided within the building such as heating lighting, cleanliness, durability, environmental impact, and energy efficiency.
- Functional performance- which refers to the characteristics the building provides the occupants such as space, layout, movement/communications, ergonomics and health and safety.
- Financial performance - which can be associated with physical and functional performance and the way in which the building is used. It can be assessed through a mixture of capital and revenue expenditure, depreciation rates, investment value and contribution to productivity, profitability and efficiency.

(Best and De Valence, 1999; Williams, 2003).

It is widely recognised that there are many other factors beyond the quality of the space, which play a role in shaping user experience although these are not necessarily reflected within existing POE models. (Brown et al 2010)

There are two distinct approaches available to evaluate building performance; quantitative and qualitative. Each of these form the bases of various established POE models, each with their own advantages and disadvantages.

Quantitative methods

McDougall *et al.* (2002) reviewed three building performance measure tools which have established methods within organisations. These are the Building Quality Assessment (BQA), the post-occupancy review of building engineering (PROBE) and the serviceability tools and methods (STM). The BQA assesses what the building provides in terms of facilities. The measurement technique is by descriptive profiles which indicate at what level facilities provide a service. It takes about two days to complete a BQA assessment which consists of nine headings with a total of 138 items resulting in a relatively comprehensive set of assessment criteria. The criteria are described on a scale from one to ten which is considered by a trained assessor (McDougall *et al.*, 2002). The tool is useful as it can give a quick provision assessment for benchmarking purposes. The tool has some limitations as the use of an assessor may be comparable more to an audit than a way of measuring the building's performance to promote ongoing development. The data generated by the assessor may lead to shortcomings as the assessor looks at the facilities alone, not the interaction of said facilities with the intended users.

PROBE studies have been conducted for over ten years and have been the most prominent tool in setting trends which address user satisfaction (McDougall *et al.*, 2002). As stated in section 1.4 PROBE studies seek to quantify technical and energy performance and combine these measures with more subjective reports of user satisfaction which provide a comprehensive outlook on buildings and their effectiveness. Specifically, the PROBE/BUS occupant questionnaire focuses on reporting the differences between buildings which gives way to an investigative approach. The questionnaire covers 43 variables which relate to environmental comfort which are then correlated with management and behavioural issues (McDougall *et al.*, 2002). As with any assessment tool, there are shortcomings in the PROBE occupant

survey as results may not reflect the actual situation but an inflated perception or other such motivator on behalf of the respondent.

STM assesses the match between supply and demand predominantly in office space. The factors in this tool are geared towards fulfilling user's needs, along with building management. STM assessment involves two parts, the first being the identification of user requirements and the second rating the building. The results can be used to illuminate areas of need within the building or also serve the purpose of guiding the procurement of new buildings. Davis, Thatcher and Blair (1993) suggested that the STM method provides a quick and economic way of setting building requirements in terms of quality, size and functionality. Thus choosing the best fit with regards to cost-effectiveness can be done promptly by comparing functional requirements against serviceability. The STM has wide-ranging scales for both occupant requirements, with 96 scales and serviceability, with 115 scales (Davis, Gray and Sinclair, 1993). Similar to the BQA, the rating is obtained from data that is collected from observable occurrences; therefore similar limitations apply to both tools. However, the STM is more in-depth than the BQA, and has been found to be a more robust tool for promoting continuous improvements in workplace settings (McDougall *et al.,* 2002).

From these quantitative methods, it can be seen that there is a difference in approach between the STM, and BQA in comparison to PROBE (McDougall *et al.,* 2002). The BQA and STM identify the building in relation to a set of predetermined criteria, which has emerged from other POEs as well as PROBE studies. The approach taken by PROBE however, attempts to gain new knowledge about the environment which can also lead to new sources of assessment measures.

The AUDE model incorporates elements of quantitative data collection and analysis within its toolkit; the primary quantitative component being the user satisfaction questionnaire. This questionnaire contains more than 70 questions aimed at identifying users' perceptions of key factors associated with internal environmental quality and other issues associated with satisfaction.

Qualitative methods:

While there are several different quantitative methods available, there is only a handful of building performance methods which take into account less quantifiable criteria. Preiser and Schramm (2002) identified that there are certain circumstances, often stemming from cultural differences, in which qualitative methods are more appropriate. This is because the evaluator is able to engage in interactive communication to help gather the needed data. Another benefit of using qualitative methods includes assessing the performance of buildings in less developed countries where illiteracy rate may still be considerably high.

Depending on the breadth of information sought, qualitative methods can serve as a general evaluation tool to aid the evaluator to familiarise themselves with the building in question. In these situations, the evaluator speaks to the building users and observes what they do and how they behave within the built environment (Preiser and Schramm, 2002). Preiser and Vischer (2005) developed the Building Performance Evaluation (BPE) which focuses on the qualitative assessment of performance. BPE looks at the building's life cycle and delivery through a list of nine performance criteria in order of priority which include health, safety, security, function, efficiency, work flow, psychological, social and cultural performance (Preiser and Schramm, 2002). The methods of acquiring this data include direct observation, still photography, survey questionnaires of building users as well as interviews (Preiser and Wang, 2008). Therefore, performance can be assessed through expert observation and consumer feedback.

The AUDE model incorporates several qualitative components including the facility for users to provide qualitative comments within the questionnaire and the potential for focus groups and interviews.

2.3.3 User perceptions of building performance and user satisfaction

A building should be able to perform functions in a way that ensures occupant satisfaction; that is the provision of the facilities needs to support the operations carried out by the users of that facility (Khalil and Nawawi, 2009). The way in which an

individual perceives his or her environment is dependent on emotive as well as perceptive-cognitive aspects. The emotive response to the building will determine how the user treats it, that is, do they find it "pleasant or unpleasant" (Gonzalez, Fernandez, and Cameselle, 1997; p. 69). On the other hand, there is the perceptive-cognitive aspect which accounts for an individual's awareness of the building's physical properties such as noise, air, illumination and temperature (Gonzalez *et al.,* 1997). The perspective of building users is important to help researchers understand how intelligently designed buildings are hoped to function better for users (Vischer, 2009).

> *"Fitness for purpose of buildings is a problematic issue for the managers of facilities with a lot of occupants and many kinds of activities" (Fianchini, 2006; p.139).*

Therefore, the designer should take into account the aesthetics, usability and functionality of the building to maximise user satisfaction.

User perceptions are important, as well as the extent to which the user can interact with actual performance of the building. Bordass, Leaman and Ruyssevelt (2001) found themes from PROBE studies which had been identified as being success factors in buildings; one of them being that users like buildings that can respond to their activities. Good outcomes arise when the building, its systems and its management are matched accordingly to the requirements of the users, the brief and the site (Bordass *et al.,* 2001). Good designs therefore allow the user to take action in an attempt to rectify a problem, or the building needs to have a management team which responds quickly to performance issues. Table 2.5 below summarises some of the key factors that have been cited as being influential upon the perceptions of building performance on the parts of building users and operators.

Tenants and Users	Owners and Managers
Functionality	Marketability
Flexibility in use	Adaptability
Cleanliness	Maintenance
Affordability	Return on investment

Table 2.5. Perceptions of Performance (Adapted from Best and De Valence, 1999, p. 201).

Although it is important to accommodate user needs, the POE process also provides a mechanism to understand the interaction between occupant needs and the building. (Khalil and Nawawi, 2009). In recent times building occupants and buyers have become more aware of the cost of building operation and what impact this has on user performance and satisfaction. The concepts of *value in use* and *value in exchange* will soon be coupled together since the higher the level of user satisfaction is perceived, the greater the value of the building will appear to future buyers as well as users (Best and De Valence, 1999, p. 176).

2.3.4 Quality and Satisfaction

Factors affecting user satisfaction

The literature described in the foregoing sections has indicated that there are several ways in which user satisfaction has been 'ranked' within various approaches to building performance measurement. Indoor environmental quality (IEQ) has been used in several instances (Lee, Guerin, 2009 and Abbaszadeh, Zagreus, Lehrer, and Huizenga 2006) where a number of IEQ criteria have been correlated with overall satisfaction with the workspace and/or building. Lee and Guerin (2009) compared mean scores on chosen IEQ criteria, with each other and with overall satisfaction as perceived by users. They assessed whether the quality of the indoor environment in LEED certified buildings led to the occupants feeling satisfied with their overall workspace and work performance. LEED is the *Leadership in Energy and Environmental Design* initiative developed by the United States Green Building Council and consists of a set of rating systems for the design, construction and operation of high performance sustainable buildings.

The seven IEQ criteria that Lee and Guerin (2009) used were:

- quality of the office
- thermal comfort
- indoor air quality
- acoustics
- lighting

- furnishings
- cleaning and maintenance

Negative correlations were identified with acoustics and thermal comfort. Dissatisfaction to acoustics was more pronounced among individuals that work in cubicles. Common complaints highlighted included co-workers being able to overhear private conversations, being able to hear the conversation of others as well as being able to overhear telephone conversations of others. Issues with thermal discomfort were identified as inaccessible thermostats, control of the thermostat by other people and the uneven heating or cooling load distribution in different areas.

Lee and Guerin (2009) also found that when mean scores in were high on any of the seven IEQ categories, so was the mean score on respondents perceived work performance. Occupants in private enclosed rooms showed the highest levels of satisfaction with their workspace as well as perceived work performance ratings. The overall findings of Lee and Guerin's (2009) work was that satisfaction with office furnishing quality showed a significant positive correlation with the satisfaction of occupants' workspace, which also correlated significantly with performance at work. Indoor air quality was also found to have an impact on the perception workers have regarding their performance (Lee and Guerin, 2009).

Abbaszadeh *et al.* (2006) took the approach of calculating percentile ranks by ranking all of the buildings in order of their mean satisfaction score with nine IEQ categories which were:

- office layout
- office furnishings
- air quality
- thermal comfort
- lighting
- acoustics
- cleaning and maintenance
- overall satisfaction with workspace and building

Other researchers in the field have found that building users satisfaction is affected by factors such as being unable to control the climate of their direct work environment and

the way the environment looks. Security of the workplaces is also a feature that impacts upon satisfaction and lack of personal and collective space features highly. (Gorgievski et al 2010)

Abbaszadeh *et al's.* (2006) findings were that occupants in green buildings were more satisfied with thermal comfort and air quality in their work space. However the average scores for satisfaction in green buildings for acoustics and lighting were comparable to non-green buildings. Out of the nine IEQ categories, they found that occupants of green or LEED certified buildings were generally satisfied with office furnishings, quality of air, cleaning and maintenance of the building, thermal comfort and reported overall satisfaction with both their workspace and the building in general.

Another way in which criteria have been identified has been by calculating the Importance Index (IM). This was created by Lim and Alum (1995) and subsequently adapted by Edet and Gidado (2008) to assess Private Financial Initiative (PFI) hospitals in the UK. Questions within a survey are put into a formula and a value is calculated by which to then rank the questions by level of perceived importance. The questions were based on a 5 point Likert scale with potential responses ranging from 'very often' to 'never' The original IM formula calculated values for seventeen questions using the following formula:

$$IM = \frac{5n1+4n2+3n3+2n4+n5}{5(n1+n2+n3+n4+n5)}$$

n1=number of respondents who answered 'very often'
n2= number of respondents who answered 'often'
n3= number of respondents who answered 'sometimes'
n4= number of respondents who answered 'rarely'
n5= number of respondents who answered 'never'

Once values were calculated, the items were classified into three relevant categories. These items were then ranked within their categories to indicate which statements were deemed most important by the cohort.

The formula used by Edet and Gidado (2008) calculated the values of 20 items, but only reported the top ten items and used a 6-point likert scale as follows:

n1=number of respondents who answered 'irrelevant'
n2= number of respondents who answered 'relevant'
n3= number of respondents who answered 'important'
n4= number of respondents who answered 'very important'
n5= number of respondents who answered 'essential'
n6= number of respondents who answered 'crucial'

Similarly to Lim and Alum (1995) once the values had been calculated, they items were grouped into four categories.

Whilst the use of an index may seem attractive in defining and measuring building performance it has been suggested that there are such differences between the perceived, relative importance of various IEQs in individual cases that the development of a single internationally valid index to be impossible. (Humphreys 2005, a Kim and de Dear, 2012)

Determining factors has been a popular way by finding out what factors affect user satisfaction. Sohail and Shaikh (2004) studied students' perceptions of service quality and came up with six factors by running factor analysis. Parasuraman *et al.* (1991, as cited by Sohail and Shaikh, 2004) proposed that classroom layout and lighting, the appearance of buildings and grounds as well as overall cleanliness significantly contribute to students' concept of service quality.

Another study which applied factor analysis is Veitch, Charles, Farley and Newsham (2007) who researched the satisfaction rates of workers in open-plan offices. Similarly to Sohail and Shaikh (2004), they conducted a factor analysis on the data which identified three factors related to satisfaction of the work area which were privacy/acoustics, lighting and ventilation/temperature. Veitch *et al.* (2007) then applied structural equation modelling (SEM) onto the data set which indicated that workers who were more satisfied with their open-plan office were more satisfied with their jobs. Previous literature had identified the ability to be able to personalise a work space to contribute to environmental satisfaction thus having an influence on job satisfaction and

employee well-being. Another study found that satisfaction with a physical work environment and job satisfaction related positively to organisational commitment and negatively on intent to turnover. Aspects of environmental design such as light quality and direction, air quality and cleanliness along with job satisfaction would be able to predict organisational commitment and intent to turnover. The more satisfied an employee was, the higher their organisational commitment was, the lower their intent to turnover (Veitch *et al.*, 2007). Overall the findings of Vetich *et al.* (2007) were that their results were consistent with previous research suggesting that occupants who are more pleased with their work environment also report greater job satisfaction.

Kim and de Dear (2012) identified that occupants who are satisfied with their environmental quality of their workspace are believed to be more productive in the work place However, some researchers feel the need to study other factors which may affect occupants' overall satisfaction with the buildings (Brown and Cole, 2009).

Kim and de Dear (2012) also found that the impact on IEQs changed depending on its perceived performance. That is, when a building performed well on the studies IEQs, they were unnoticed by the occupants. However, when the IEQ factors performed poorly, they prompted significant overall dissatisfaction with the building. They also pointed out that traditional POE questionnaires do not take into account qualities such as daylight, aesthetics, and window views etc.; all which potentially add enjoyment or satisfaction to building occupants. LEED, BREEAM and Green Star questionnaires incorporate such issues therefore the authors considered this to be a limitation of the tool they used relative to the available alternatives. They make a recommendation for building managers specifically to be aware of how IEQ factors can influence occupant satisfaction in a building in order to make more informed decisions as to where occupant workspaces or other areas should be located.

Bluyssen, Aries and van Dommelen (2011) assessed the perceived comfort of office workers. They found that satisfaction and personal control contributed strongly to feelings of comfort reported by the participants in both summer and winter seasons. The application of a regression model found that perceived summer comfort related to social characteristics such as requesting improvements on HVAC and other aspects. In the winter months however, the model found that the office environment made the most

significant contribution to comfort. In both seasons, layout of the office influenced perceived comfort reported. They recommended that future research should take into account interactions with other aspects such as mood, tiredness, amount of daylight as these can have a significant impact on the results that are acquired. It has also been noted that there should be more focus on asking participants how satisfied occupants are with environmental features such as flexibility of a work station, where their work station is located, what the office layout is etc. as these may provide more insight into what makes a space more enjoyable than others as opposed to the traditional factors such as acoustics, ventilation and access for example. (Bluyssen *et al.*, 2011)

Frontczak and Wargocki (2011) reported that temperature was a more important factor than air quality, acoustics or visual comfort. In their assessment, they found that qualitative assessment of environmental parameters only ranked the factors which building users deemed important. On the other hand, quantitative methods provided more in depth information because the extent to which environmental condition should be changed in order to create a change in comfort was indicated. However, their work also illustrated that there was a considerable level of variability in the perceived importance of the defined IEQ factors within different studies. Figure 2.9 below shows that degree to which factors associated with defined IEQ elements were considered as important in relation to overall satisfaction in 8 separate studies drawn from a large Post Occupancy Evaluation (POE) database (Zagreus et al., 2004). Several of these studies related specifically to educational facilities. This work suggests that the impact of IEQ factors varies depending upon context and upon the level to which the various factors are satisfactory or otherwise. The work recognised that whilst individual factors were identified as satisfactory, the impact upon overall ranking of their importance was different from when those same factors were identified as unsatisfactory. The linkage between IEQ factors and occupant satisfaction is questioned by some observers due to the potential for a distortion of overall results due to other factors in the user/facility dynamic. (Leaman and Bordass, 2007; Bluyssen, 2010)

It is now a commonly held view that changes in occupants' overall satisfaction do not necessarily correlate with variances in the measures of individual IEQ factors (Humphreys, 2005; Bluyssen et al., 2011). It is posited that conclusions regarding the

basis of user satisfaction need to be cognisant of broader, contextual factors such as personal, situational and social factors. (Bluyssen, 2010; Brown and Cole, 2009).

The work undertaken by Frontczak and Wargocki (2011) aimed to identify the relationship between occupants' overall perception of the building environment and their assessment of the performance of individual IEQ factors. Figure 2.10 below illustrates the outcomes of the study, which showed that there are significant inconsistencies in the relationship between IEQ factors and overall satisfaction in different scenarios.

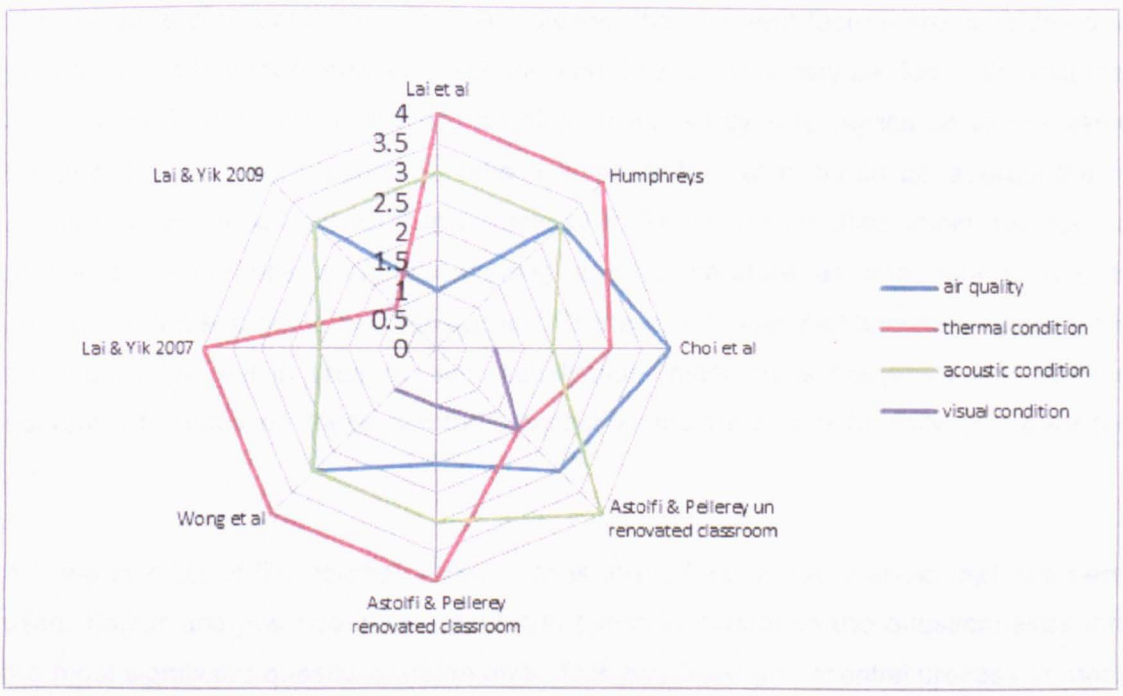

Figure 2.10: Previous researchers' attempts at ranking (higher number indicates higher ranking) of importance of IEQ factors for overall satisfaction (Frontczak and Wargocki, 2011)

Several researchers have studied the impact and influence of IEQs within educational settings and a series of broad themes can be identified from their collective works. Leung and Fung (2005) identified good lighting levels as a factor that influenced user satisfaction positively. This is supported by Heschong (2003) who found that the quality and amount of natural daylight was influential upon student performance. In contrast Winterbottom and Wilkins (2008) noted the negative effect of glare from excessive

lighting levels. In several studies of user satisfaction within a range of building types the impact of thermal comfort has been repeatedly identified as a key factor in achieving user satisfaction. This is true also of educational facilities. Hwang et al (2006) identified a range of attributes affecting thermal comfort in educational facilities and noted that this was one of the key influencing factors upon user satisfaction and performance. Noise and acoustic comfort have also been cited as influencing factors in learning facilities with particular focus on noise cross-over between spaces and in-room acoustics (Crandell and Smaldino 2000)

The literature considered thus far has indicated that different factors are considered to be more important than others in each individual case. This may be due to the fact that each study focuses on a different building. If the study was replicated in the same building over a certain period of time it is possible that it would be appropriate to develop a valid index but for that building only. The research cited within this section repeatedly references acoustics, lighting and temperature as important factors to consider when exploring user satisfaction. There is a danger that knowing which one is the most important in creating user satisfaction might invite designers and building operators to focus on these comfort/satisfaction factors and potentially disregard the rest.

A trend in most of the sources referred to is the nature of the analysis that has been used. Factor analysis has been popular in trying to condense the questionnaires into the most significant questions/statements. This has been an essential process in many cases due to the size and perceived complexity of the initial questionnaires applied

The process of building performance assessment using POE focuses on the issues of quality and satisfaction, however these terms are often ill-defined within literature. It is appropriate to consider how these elements are defined and measured.

Defining Quality

When searching for definitions relating to quality within the built environment, the majority of findings relate to indoor air quality. The field of marketing however, has a

vast body of research relating to quality and satisfaction. Practitioners tend to use the terms service quality and customer service interchangeably, yet academics are aware of the differences between these two concepts (Caruana, 2000). From the customer's point of view, quality is two dimensional. The first dimension relates to the output (i.e. what was delivered to the customer). The second dimension is the process function (i.e. how the end result was transferred to the customer). Perceived quality experienced by customers is the result of evaluations they make of what was expected and what was experienced whilst taking into account the influence of the organisation's image. Teas (1993) defined perceived quality as the degree and direction of discrepancy between consumers' perceptions and expectations.

It can be taken as axiomatic that quality means a different thing to different people. However, there are several broad characteristics associated with the term that are cited repeatedly. Ghobadian, Speller and Jones (1993, p. 47) found that generally, definitions of quality fall into five categories which were:

- transcendent-relating to innate excellence
- product led-relating to units of goodness packed into a product/service
- process/supply led-relating to conformance to requirements
- customer led-relating to fitness for purpose and satisfying customer requirements
- value led-relating to the cost of the producer and price to the customer

Ghobadian *et al.* (1993) also stated that companies with perceived high quality goods and services tended to have higher market shares, higher return on investment and asset turnover than companies with perceived low quality. This has led to the conclusion that the most important factor affecting business performance in the long term is in the quality of goods and services offered by the organisation, relative to its competitors.

> "*Service quality is considered a critical determinant of competitiveness* (Ghobadian *et al.*, 1993 p. 44)."

There is increased focus upon user satisfaction within Higher Education estates together with an increase in users' perceptions of education in terms of service delivery. However, this is not necessarily translated in to the evaluation and performance management of the physical estate. There is increased recognition of the link between the quality of higher education facilities and the potential of effective design and FM to create value by facilitating student recruitment and improving the student learning experience. (Vidalakis et al 2013)

Although almost all HEIs adopt robust measures to assess and manage building condition the use of measures to gauge user satisfaction with the estate are less common. It has been suggested that in the face of potential criticism of aspects of facilities, some Directors of Estates may be resistant to the adoption of such approaches. However, it is generally considered the introduction of student fees in England is likely to be a catalyst for increased student expectations associated with the physical estate. It is still typical for HEIs to adopt a technical/functional view of the facilities and estate even though it is recognised within architecture and FM that the physical infrastructure has a great influence upon organisational change and customer service quality. (Andrew 2009)

Allied to this, the core mission and principles of FM delivery must be reflected upon. Spedding and Holmes (1994) assert that the aim of FM should be

> *"not just to optimise running costs of buildings, but to raise efficiency of the management of space and related assets for people and processes, in order that the mission and goals of the organisation may be achieved at the best combination of efficiency and cost."*

These factors would appear to justify a shift towards service quality approaches that support organisational effectiveness rather than technical evaluations of facilities and estates. Such a shift has already been identified within the broad field of facilities management and considerable work has been undertaken associated with FM customer service models. (Tucker,M. & Pitt,M. 2009)

In developing a conceptual model for generic customer service, which is illustrated in figure 2.11, Parasuraman et al (1985) identified five propositions as follows:

Proposition 1: The gap between consumer expectations and management perceptions of those expectations will have an impact on the consumer's evaluation of service quality

Proposition 2: The gap between management perceptions of consumer expectations and the firm's service quality specifications will affect service quality from the consumer's viewpoint

Proposition 3: The gap between service quality specifications and actual service delivery will affect service quality from the consumer's standpoint.

Proposition 4: The gap between actual service delivery and external communications about the service will affect service quality from a consumer's standpoint

Proposition 5: The quality that a consumer perceives in a service is a function of the magnitude and direction of the gap between expected service and perceived service.

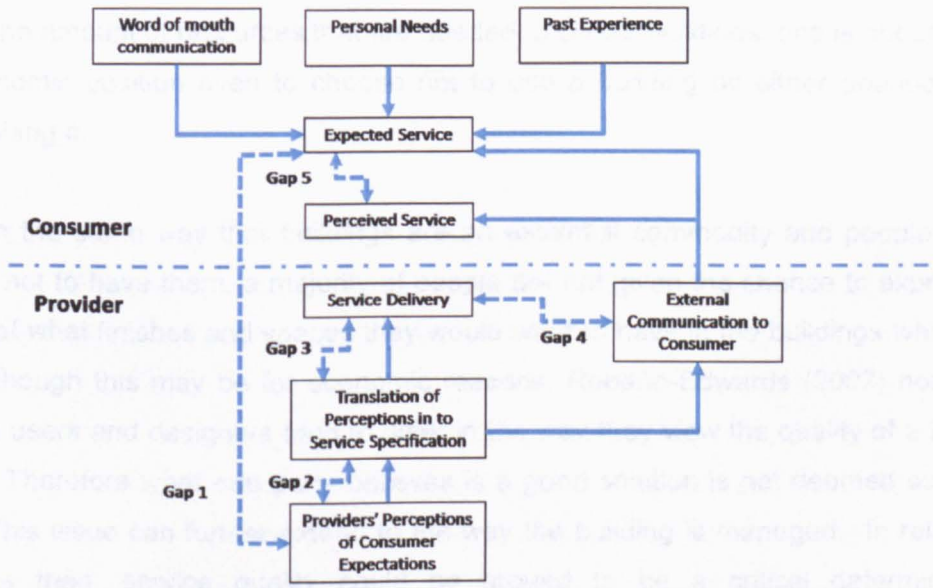

Figure 2.10: Customer Service Model (Based on Parasuraman, A. et al 1985)

The translation of such a concept to the performance of a building is logical but requires a degree of contextualisation. In briefing and design stages, there is a considerable gap between clients and designers when the clients specify requirements and review the design solutions.(Shen et al 2012) Buildings act as enablers to the delivery of functions that differ from context to context. Within Higher Education the building provides a vehicle for the delivery of the core business in terms of study for students and workplace for staff. The essential dynamics of the interaction between these users of buildings and the enabling elements of the building or facility is similar to that of the stakeholders within the customer service model. It is possible that POE can provide a mechanism for addressing the gaps identified within such a model between user expectations and actual quality of 'service' delivery. Eley (2004) stated that

"Buildings are an essential commodity rather than an optional one"

Therefore measuring quality in a building is not as straightforward as measuring some other commodities. There are many factors which make measuring building quality much more complex, such as the fact that people cannot choose not to have buildings because they do not like them as they provide shelter from the elements. In addition, due to the amount of resources that are needed to create buildings, one is not usually in an economic position even to choose not to use a building by either abandoning or demolishing it.

In much the same way that buildings are an essential commodity and people cannot choose not to have them, a majority of people are not given the chance to express the quality of what finishes and spaces they would want to have in the buildings which they use. Although this may be for economic reasons, Rebaño-Edwards (2007) noted that building users and designers tend to differ in the way they view the quality of a building design. Therefore what one party believes is a good solution is not deemed so by the other. This issue can further extend to the way the building is managed. In relation to buildings then, service quality could be argued to be a critical determinant of satisfaction with the building. However, we are still left without an accepted, consistent definition of what is meant by the term 'quality' in the context of building performance.

Defining Satisfaction

Occupant satisfaction has been defined in relation to indoor environmental quality or the workspace (Frontczak, Schiavon, Goins, Arens, Zhang, and Wargocki, 2012).

Caruana (2000) identified that one of the difficulties in looking at what precedes and follows from customer satisfaction is the lack of a unanimous view of what satisfaction means. Giese and Cote (2000) have researched customer satisfaction and determined three components for it. As such, their definition is:

> *"a summary affective response of varying intensity, with a time-specific point of determination and limited duration, directed toward focal aspects of product acquisition and or consumption"*

Kotler (1997 cited in Mbachu and Nkado, 2006, p. 32) on the other hand, defined satisfaction as "a person's feelings of pleasure or disappointment resulting from comparing a product's perceived performance or outcome in relation to his or her expectations."

Mbachu and Nkado (2006) expressed the notion that the construction industry may have a higher rate of clients who are dissatisfied and are more critical than in other industries. This may be related to the point raised by Rebaño-Edwards (2007) that building users and designers have differing views regarding what constitutes quality in a building design, thus leaving clients more dissatisfied with what they are handed over upon the completion of a construction project. Conversely, Mbachu and Nkado (2006) specified that client satisfaction reflects positive outcomes from the expenditure of scarce resources or unmet needs being fulfilled.

The absence of specific and agreed definitions for quality and satisfaction as terms associated with building performance impacts heavily upon the process of POE. This is particularly so because both terms are used heavily in both the process of data collection and analysis and the reporting of outcomes of the POE process.

When considering the evaluation of building performance, it is important to bear in mind that buildings experience significant occupant and internal changes over their life cycle,

such as refurbishments or new occupants. The implementation of POE into such a dynamic setting would be advantageous as it may result in satisfied end-users who are less critical of the facilities if their needs are understood during every phase of the construction process (Pemsel, Widén and Hansson, 2010). Although some occupants may not be aware of it, if they actively take part in the processes prior to building procurement they are more likely to enjoy the outcome and functionality of the building (Pemsel *et al.*, 2009).

Monitoring the state of technical systems is another driver for change as upgrades should be scheduled into maintenance (Augenbroe and Park, 2005). An example of scheduled maintenance comes from Ornstein *et al.* (2009) as they looked at the refurbishment of a psychiatric hospital in Brazil. The facilities needed to be modernized to be more appropriate for the treatment of patients with mental illnesses, rather than resemble a prison. The bathrooms were not equipped to be used by handicapped *(sic)* and both the plumbing and electrical wiring were in desperate need of repair since their installation in the 1940s. Although the institute served primarily as a psychiatric hospital, it hosted other activities such as education and research, therefore a broad perspective of users' needs and requirements was needed so that each area could be effectively refurbished for their intended purposes.

2.4 Summary of POE in the context of Higher Education Facilities

The research that has been undertaken by the author relates to the specific environment of Higher Education institutions. Hence, it is worthwhile considering the nature and context of buildings in Higher Education institutions and the relevance of POE within the chosen setting. Higher Education has been an area in which POE has found a degree of favour and which has a body of previous work that allows comparisons to be made.

As with identifying the relevant stakeholders when conducting a POE, one needs to be aware of all the facilities that comprise a Higher Education institution (HEI). Such facilities range from lecture theatres, classrooms, libraries, learning resource centres (LRCs) and student accommodation to administrative buildings for example. Although, in the main, these areas carry out functions they were designed to do with little change over time, technological developments have seen a marked intensification in the ways that these spaces are now required to serve their users.

Libraries are used as facilities traditionally to store books and archives which people are free to access, however, in the past few decades technology has been infused into library settings (Preiser and Wang, 2008). A Learning Resource Centre is a meeting place where information and advice can be sought; where research can be conducted; and student study group sessions can be held. Therefore, the individuals can access hardcopy knowledge from books, and electronic knowledge through computers (Preiser and Wang, 2008). The occupants of LRCs include students, university faculty members, and researchers (Hassanain and Mudhei, 2006). Not only can users have access to the study materials which are relevant for their course, but also use the internet, word processors, spreadsheets and other available software (Revill, 1997; Preiser and Wang, 2008). The aim is to provide the LRC users with printed materials and computing services under the same roof (Revill, 1997).

Within the scope of Higher Education facilities it is recognised that a number of potential methods exist for the evaluation of facilities performance. The AUDE model sets out a toolkit for the assembly of appropriate models in different circumstances but there is no single defined approach to POE that is universally accepted. It is suggested that POE

methods should be selected based upon the uniqueness of the space and the needs and objectives of those conducting the evaluation. It is also recognised that educational facilities must be designed with reference to feedback obtained from their immediate users.(Hassanain et al 2012)

Over the years, POE has been adopted in Higher Education and to identify and resolve performance issues in existing facilities. It has also been applied as a tool to develop design guidance and performance measures for future projects, seeking to learn from experience and to feed forward lessons learned. This is exemplified by the work of Khalil and Husin (2009) in relation to architectural design studios. However, it has also been applied in other educational contexts, where it was found that the absence of a linkage between building end users and those informing design decisions was a key factor affecting the final performance of the facilities. (Sanoff 2001)

This, inevitably, results in the exclusion of the potential knowledge base of the direct users of the facilities, including teachers and students. Zhang and Barrett (2010) consider that a gap exists in educational facility projects between the designer's objectives and the actual performance level achieved in practice as a result of the schism between the end users and those making the design choices.

2.4.1 Establishing the scope of HEI performance

Hassanain and Mudhei (2006) identify two key elements of performance in the context of Higher Education buildings; the technical elements and functional elements. The technical elements deal with performance in terms of health, security, how well building systems perform and safety. These are often classified as the surrounding environment for carrying out intended activities. Functional elements, on the other hand, deal with the fit between the user's activities and the building. These elements support the activities carried out within the building, and they must be responsive to the specific needs of the occupants and organization. Ultimately the goal of any educational facility is to provide its users with a space to study, work, conduct research, to teach and be productive. Environmental comfort is considered to be important when trying to promote such activities (Ornstein, Moreira, Ono, França, and Nogueira, 2009).

Watson (2003) published results on POEs that had been conducted on educational buildings in New Zealand which included specific examples from technology centres and student accommodation. An appropriate group of experts was recruited to take part in the walk-throughs. the evaluations took place, which produced very favourable results. The recommendations made ranged from access levels, good acoustic conditions and lighting in classrooms. The Ministry of Education reported that POE helped identify:

> *"a measurable link between building quality and educational outcomes, which is notoriously difficult to show"*
> (Watson, 2003; p. 17).

Andrew (2009) noted that in HEIs the issue of functionality in relation to fitness for purpose is important but that buildings can be functional but unpleasant. Additionally, that some HEIs have very pleasing estates with the incorporation of 'non-functional' spaces such gardens and other open areas that are valued by staff and students. Thus the consideration of overall performance needs to go beyond simple measurement of functionality.

Whilst the need for the assessment of overall facilities performance in HEIs has been recognised it has been inhibited by a range of factors including the following as cited by Amaratunga and Baldry (2000):

- weak performance evaluation practices and slow development of theories and processes (Preiser, 1994)
- lack of acceptance of, and training in, qualitative methods of performance evaluation (Pariseau and McDaniel, 1997); (Tilke, 1995);
- inconsistent interpretation of what performance evaluation means, how it is to be pursued (Belcher, 1997) and how it can lead to improved performance. (Finch and Clements-Croome, 1997);
- lack of objective performance metrics (Barrett, 1992); with performance evaluation being based on experience based rather than empirical study(Davis,1996);
- poor management commitment (Preiser, 1995).

POE has been identified as a way of helping to assess the performance of education buildings by providing library administrators with feedback on space utilization and technical systems effectiveness (Hassanain and Mudhei, 2006). Preiser and Wang (2008) implemented a mixed methods approach to assessing library performance in Higher Education institutions by analysing usage, capacity, demographic features, and the spatial distribution of the library. The quantitative approach entailed the use of a Geographic Information System (GIS) to evaluate the building system by analysing and presenting spatial data while the Building Performance Evaluation (BPE) was used to uncover qualitative data. Staff members were asked about their views on the performance of the library as well as circulation records, number of staff and the library's opening hours. Other factors such as the condition of the building and physical attributes such as space, lighting, noise level, security, accessibility for the disabled and furnishings were taken into account when establishing whether the building was meeting the needs of the users, and whether these needs were being fulfilled to poor, adequate or good standards (Preiser and Wang, 2008). This work was carried out on library buildings, which have specific user needs sets. However, there are some areas of cross-over between such environments and the generic grouping of educational buildings. The designer should keep the assessment criteria delineated for education buildings in mind while creating a space specifically tailored to this setting as conditions to carry out required activities is important for personal productivity and overall usefulness of the building and what it was intended to do.(Kusack J. 1991; Fielden R. 1995; James D. 1995)

POEs report on how a user functions within the spaces a building provides while also looking at the systems and operation aspects of the building (Vischer, 2009). As HEIs include numerous facilities which are used for different purposes, it appears to be a fertile area for research. Watson's (2003) study found that the POE process was able to identify a link between building quality and educational outcomes which has generally been found to be difficult to show. POE has also been cited as a method of identifying elements, or factors, pertinent to a comfortable environment within HEIs. These include visual, thermal, and acoustic considerations, privacy, way finding, as well as layout/space utilization and fire safety (Hassanain and Mudhei, 2006).

It has also been proposed that, in the context of HEIs

> *"lighting influences user comfort, productivity, and perception of space"*

(p. 232; Augenbroe and Park, 2005; Pati *et al.*, 2009).

In order to be able to offer the building users a pleasant environment that is conducive to work and study as well as the thermal comfort of the occupants should be provided (Augenbroe and Park, 2005; Pati *et al.*, 2009.) Hassanain and Mudhei (2006) also mention the acoustic considerations which are important in a HEI setting such as speech privacy, loud mechanisms by quiet areas, noise intrusion from other spaces and so forth. Research by Ornstein *et al.* (2009) also suggested that individuals benefit from natural lighting and spaces which are designated for relaxation and socialising, as well as environments which provide pleasant sensory experiences with the use of colour and fabrics.

POE can be used to evaluate the effectiveness of the study experience that the occupants seek and compare it to the extent that they report having these needs met. The process can also help uncover particular areas within the building that may deter human activities, thus leading to discussion and hopefully implementation of improvements in the building (Fianchini, 2006).

2.5 Chapter Summary

This chapter set out to consider the background and prior relevant work in the field of POE and its application in the context of the Higher Education sector in England and Wales. It is clear that the use of POE is established and accepted, to varying degrees, within the design and operation of buildings in a range of sectors. The Higher Education sector is one in which POE has been applied for many years although its effectiveness has been subject to criticism from some quarters. This is, in part, a consequence of the perceived complexity of the models that have been applied in the past. There is also a strong perception that the cost of the process may be a major inhibitor to its widespread adoption.

Whilst the benefits of the process are recognised within both the design professions and amongst building operators, there is a divergence of view regarding its fundamental purpose. The origins of POE lie within the design arena, in which it is largely considered to be a tool for feeding lessons learnt in to an evolving and improving knowledge base to support building design and construction. Its use within the area of facilities management and building operation has been linked to this also. In addition it has been applied as a tool for building improving building functional performance and for performance benchmarking. In many instances the application of the process is linked to post project review with its purpose being to evaluate the performance of the process project delivery rather than the physical and functional performance of the building or facility. Unlike other tools used to evaluate buildings, POE sits at the boundary of technical performance measurement and environmental psychology. As such it recognises that buildings are enabling environments for human activity and attempts to assess user satisfaction as part of facilities evaluation. In some instances POE is linked to both building performance and project delivery. Several of the POE models available attempt to capture both of these aspects. Although the benefits are recognised the mainstream application of the process is still limited, and the variation in the models that have been developed is an indicator of the differing aspirations of its proponents. Each of the models identified within the chapter has been developed to deliver what is broadly termed as POE, yet they vary immensely in concept, methodology and detail.

It seems clear that there are issues to be overcome in establishing POE as a credible tool in the main stream. Uncertainty about the validity of the process along with ignorance of its benefits may contribute to the problem. It would appear that if the process is to be accepted in both the design and operation of building mechanisms there must be clear tangible benefits that outweigh the perceived resistors. In particular it is desirable to reduce the complexity and cost of POE, to improve the validity of the data gathering and analysis and to reduce the time lag inherent in the process. In addition the models for disseminating the acquired knowledge on a wider basis must be developed to allow the benefits of repetition across a sector rather than within a single organisation. Once these aspects have been addressed the process of POE stands a chance of becoming a widely accepted and applied tool for the effecting of measured evolution within organisations wishing to maximise the facility-user compatibility and thus achieving operational benefits.

The English and Welsh Higher Education sector has been under pressure to evaluate be capital projects and to evaluate and benchmark the performance of buildings in use. The AUDE POE toolkit has been developed specifically to support this agenda. However, the extent of application of the model and the degree to which it delivers the requirements of its users is not yet clear. There is an apparent reticence on the part of those within the Higher Education sector to embrace existing structured models such as the AUDE toolkit. Instead, preferring to opt for custom-made or bespoke POE solutions that they consider to be better suited to their individual purpose. These established and custom-made models apply differing approaches to the process of evaluation, with aspects of both qualitative and quantitative enquiry. The initial indicators suggest that the degree to which they deliver the requirements of their users is mixed. This is in part considered to be due to users' perceptions of the complexity of the models and it is suggested that a simplified, more affordable approach would be more valid.

The main findings of the literature review are as follows:

- The importance of buildings as an enabler to the delivery of Higher Education processes is recognised by HEIs and extensive work has been undertaken across the sector to develop mechanisms for enhancing facilities performance.

- POE is recognised as a valuable tool for the assessment of facilities performance across a range of dimensions including qualitative and quantitative elements, but is not consistently applied to capital projects.
- Differing levels of POE intervention are commonly considered appropriate depending upon context and purpose including indicative, investigative and diagnostic options.
- A range of internal environmental factors is commonly identified as being influential upon user satisfaction; the most commonly cited factors are associated with thermal comfort and acoustic comfort and perceived 'quality' of spaces.
- The performance of facilities is more complex than the delivery of simple technical performance requirements. Facilities operators and users also identify perceived service quality, functional performance and financial performance as key elements of evaluation.
- Numerous models of POE exist and are in common usage, however, the notion of a single common framework or model is inhibited by the vast range of differing facilities and organisational contexts.
- There are differing views on the purpose of POE. It is seen by some as a building performance evaluation tool and by others as a tool for reviewing project delivery.
- Whilst POE is seen as a useful tool for enhancing facilities and organisational performance its widespread use within HE is inhibited by high cost of application, perceived complexity and potentially inclusive outcomes.
- The extent to which POE outcomes are used to feed forward lessons learned on individual projects is variable across the sector.
- POE is not fully integrated within facilities and organisational systems and structures within HEIs and is subject to scepticism from the senior management within some HEIs.

The review that has been effected within this chapter illustrates that the selected topic provides scope for further research within the project to address the areas discussed above. Specifically, the areas that warrant further research relate to the perceived purpose of POE on the part of its users in Higher Education and identification of the

intended outcomes of the process. In addition the relative merits of defined POE models and custom-made solutions merit consideration, together with the degree to which they are deemed to fulfil the requirements and expectations of their users. Accordingly, the following chapters set out the basis of the research project and its findings.

3.0 Research Methodology and Design

3.1 Introduction and Background to the Research Topic

This chapter sets out the various methodologies that were considered by the author and describes the approach that was selected to undertake the research. The basis upon which the final methodology was selected is described together with discussion of the various alternatives that could be applied and justification for the selection of the preferred option, which was a mixed methods approach. This approach featured elements of both qualitative and quantitative data gathering and analysis at various stages within the work. The reasoning behind the selection of these components is discussed together with explanation of the broad structure of the project.

The initial literature review provided a mechanism for the exploration of the existing knowledge base relating to post-occupancy evaluation as a tool for the assessment and manipulation of building quality and satisfaction. It allowed the author to develop and expanded knowledge base relating to the form and evolution of POE and the various tools and techniques that have been utilised in its application. One of the key objectives of the literature review was to confirm that there was potential for the undertaking of structured research to liberate new knowledge and understanding in areas that could not be addressed through review of the existing body of literature.

The primary aim of the project was to assess the efficacy of the process of POE within the context of Higher Education institutions in the UK and to develop a viable and valid model for its more effective application, based on grounded and well developed principles and concepts. The literature review was structured and undertaken with the aim of addressing several specific objectives associated with the process of POE and its application in Higher Education institutions. These were as follows:

- To gain understanding of the historical evolution of post-occupancy evaluation and define the various common models that are in use.
- To define the context of POE as a tool for building design and management with particular reference to its application within the UK Higher Education sector

Developing from the literature review a further series of research questions was posed that formed the basis of the empirical part of the project. These are as follows:

To what extent do those involved in producing and operating Higher Education buildings understand and apply POE ?

What are the intentions and expectations of users of POE when applying it?

Does the application of POE liberate tangible benefits and improved satisfaction on the part of building users?

Are there key factors that affect users' perceptions of satisfaction with buildings and do existing POE models identify these?

Are the existing models of POE fit for purpose when applied in HEIs?

The literature review gave partial answers to these questions and liberated a deal of data that supported the notion that POE is a well-established and commonly applied tool for the improvement of building design and performance. However, it did not provide data that allowed detailed understanding why and how it is applied in Higher Education institutions. Nor did it provide data relating to the expectations, experiences and perceptions of its effectiveness on the part of those stakeholders involved in its application. As a result it was considered that a research project based on the gathering and analysis of primary data was appropriate and the outcomes of the literature review provided sufficient to allow the development of a research approach and methodology.

3.2 Overview of potential methodologies

There are essentially three types of methodology which can be incorporated into research projects. These include the quantitative, qualitative and mixed methods approaches to investigation. Creswell (2009) pointed out that while the three types use different methods of data collection, they all fall within the same continuum, rather than being separate from one another. The challenge in developing an approach to this project was to decide at what point on the continuum to settle in establishing an appropriate methodology.

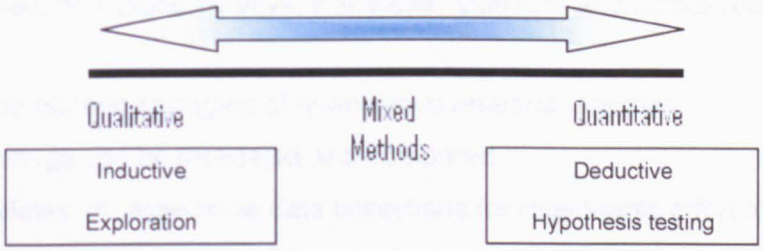

Figure 3.1. The methodology continuum.

Figure 3.1. depicts the three approaches to research methodology. At the two extremes are the quantitative and qualitative fields, which are often viewed as polar opposites by the proponents of each approach. Placing mixed methods in the middle, however, indicates that there are certain elements of both quantitative and qualitative methods which can be integrated, thus forming the mixed methods approach. In the context of built environment research several commentators have supported an approach in the mid-ground of this continuum, counselling against the tendency to engage in 'turf wars' regarding methodology. (Raftery et al 1997, Wing et al 1998) Pragmatic approaches that are valid in terms of relevance and rigour are essential in deriving legitimate conclusions. The three approaches will be discussed in depth below and the points of view which advocate their use.

3.2.1 Quantitative approaches

Quantitative research is driven by post-positivist knowledge - that is, the current state of knowledge and theory, and is often confirmatory in nature (Creswell, 2009). The quantitative approach has a long standing tradition which values numeric data and assumes that they represent concepts or opinions which are still dominant in academic settings today (Amaratunga, Baldry, Sarshar and Newton, 2002). As such, it has an abundance of defined research designs which can be implemented for analysis (Teddlie and Tashakkori, 2009). Quantitative data is interested in testing hypotheses and generalisable theories (Amaratunga *et al.*, 2002) often through close-ended surveys, and experiments (Creswell, 2009). The structure of a quantitative report is often set, including an introduction, literature review, methodology, results and discussion sections. Amaratunga *et al.* (2002) noted that this type of methodology is best when

used to examine behavioural components in built environment research, as the modes of data collection include surveys, interviews, statistics and official reports.

Some of the generic strengths of quantitative research are that:

- Findings can be replicated and compared
- It allows for large-scale data collections for reasonable effort and cost as well as provides statistical proof
- Objective methods of analysis are undertaken

Quantitative analysis has gained a body of support in built environment research as a consequence of its basis in defining epistemological methodologies that can determine the validity or truth- value of propositions, allowing repeatability and flexibility in treatment of data and analyses to verify reliability. (Cotgrave, A., 2008)

Creswell (1994) defines quantitative research as inquiry relating to social/human problems that is based on testing theories or hypotheses composed of variables that can be measured numerically and analysed with statistical procedures to test whether the theory or hypothesis holds true.

In the specific context of built environment research quantitative research methodologies have the following strengths:

- Ability for comparison and replication
- Independence between observer and observed
- Measurement though objective methods rather than subjective inference
- Greater objectivity in determining reliability and validity than qualitative methods
- Strength in measuring descriptive aspects of built environment
- Emphasis on the need to develop a hypothesis for subsequent verification
- Reduces the whole to the simplest elements in order to facilitate analyses and assist in searching for causal explanations and fundamental laws

(Adapted from Cotgrave (2008))

Some of the weaknesses of quantitative data are that it may be time consuming for the participant, and also for the researcher in collecting and completing data forms, thus often resulting in a low response rate. The data collected may only represent an 'of the moment' depiction of what is going on; therefore findings may not be generalisable, or true to a large extent (Amaratunga *et al.*, 2002). Quantitative methods are also unable to explain such elements as sensations or provide insight into facets that require a more narrative or descriptive approach. Quantitative approaches are essentially deductive and are aimed at testing hypotheses as illustrated in the hypothetical-deductive research model shown in Figure 3.2. As such they require a greater level of pre-emptive structure in data collection processes to allow the measurement of relationships between defined variables.(David, & Sutton 2011)

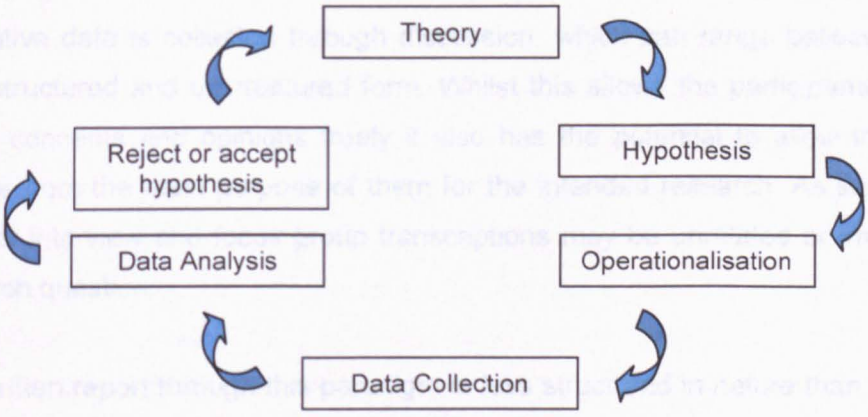

Figure 3.2: Quantitative – hypothetical – deductive research model. (adopted from David & Sutton 2011)

One of the disadvantages of the use of quantitative data collection is that, in order for the data to be reliable, there is a requirement that the data collection tool is near perfect as there is likely to be only one chance to collect the data. In addition it is necessary to utilize a sufficiently large sample to ensure that the results allow for valid statistical analysis. (Cotgrave 2008) Whilst it may be possible to pilot quantitative data capture tools to reduce the potential for error or omission it is difficult to illustrate all potential failings of the proposed tool and to remedy them prior to full implementation of the data collection process.

3.2.2 Qualitative approaches

The qualitative approach explores the meaning that individuals and groups assign to social and human problems. Dey (1993) defines qualitative analysis as a series of related processes involving the description and classification of phenomena and the examination of interrelationships between concepts. It may involve the description, classification, categorization and coding of data to allow the ability to identify connections and comparisons leading to an end result. Data in this method is gathered in the participant's setting. Data is analysed inductively which builds from subtleties from the conversation into more general themes and intended meanings. This mode of inquiry takes on a constructivist and participatory approach to knowledge therefore the researcher makes an interpretation on the meaning of the data (Creswell, 2009) rather than using statistics to see whether assumptions were met. It is generally the case that qualitative data is collected through discussion, which can range between structured, semi-structured and unstructured form. Whilst this allows the participants to introduce ideas, concepts and opinions freely it also has the potential to allow the process to deviate from the main purpose of them for the intended research. As such, significant parts of interview and focus group transcriptions may be unrelated or irrelevant to the research question.

The written report through this paradigm is less structured in nature than a quantitative report as the researcher needs to convey meaning and importance rather than facts and figures and thus can take on a more narrative or descriptive approach. The reliability of qualitative methodologies may be questioned due to the potential for inherent bias on the part of the researcher resulting from their own experiences and perceptions. However, this can be overcome to a large extent by undertaking validity tests on the data and the resulting analyses.

Qualitative methods have become increasingly popular in the social sciences as it enables deeper understanding of the dynamics of social phenomena (Attride-Stirling, 2001). However, qualitative research is still not regarded as solid empirical research because there has been on-going debate as to how to ensure rigour, or validity within the methods used (Morse, Barrett, Mayan, Olson and Spiers, 2002), whereas such

matters are more readily justified in quantitative inquiry. It is often the case that quantitative methodologists and even qualitative methodologists have a preconception that qualitative research is unscientific, invalid and not reliable because there are no set rules as to how to go about conducting this type of research (Morse *et al.*, 2002). While there is a general understanding that the type of data which is collected through qualitative methods is different from quantitative methods. There should therefore be different criteria for assessing the validity of the work conducted in a specific paradigm. In qualitative terms, then, the terms associated with rigour are transferability, confirmability, dependability and credibility (Morse *et al.*, 2002).A further misconception about qualitative studies is that they are merely used for explorative purposes, before implementing a 'robust' empirical method (Sale, Lohfeld, and Brazil, 2002).

An analytic tool commonly used in qualitative analysis is the use of thematic networks. Thematic networks are used to explain the understanding of an issue by making connections between the statements that people make and the meaning they are trying to impart through conversation, or discourse (Attride-Stirling, 2001). The way in which thematic networks are used to analyse discourse is by identifying the most prominent themes from the text and representing these themes visually or graphically. Attride-Stirling (2007) proposed a method of extracting discourse themes by picking out the basic themes which are key words which provide a basis for themes to build upon. Organising themes are formed when the basic themes are grouped together into similar issues to summarize theoretical principles. Lastly, there are global themes which encompass the ultimate meanings of the overall text; there will be fewer global themes than there are organising and basic ones, as global themes are basically the umbrella which cover other notions within.

Grounded Theory

It has been posited that grounded theory is *'ideal for exploring integral social relationships and the behaviour of groups where there has been little exploration of the contextual factors that affect individual's lives'*(Crooks 2001)

Charmaz (2006) identifies a number of features that are consistent in all grounded theories as follows:

- simultaneous collection and analysis of data
- creation of analytic codes and categories developed from data and not by pre-existing conceptualisations (theoretical sensitivity)
- discovery of basic social processes in the data
- inductive construction of abstract categories
- theoretical sampling to refine categories
- writing analytical memos as the stage between coding and writing
- the integration of categories into a theoretical framework.

The nature of grounded theory as a research approach is different from other qualitative research approaches in that the researcher may have some views and perspectives relating to:

- how to start the research (identifying area of interest, avoiding theoretical preconceptions and using theoretical sensitivity)
- how to do it (through analytical procedures and sampling strategies)
- how to stop (when theoretical saturation is reached)

(Dey 1999)

Grounded theory has its own criteria for assessing the rigour or quality of the study (Glaser 1978):

- Fit and relevance - how well do the categories relate to the data and derives from constant comparison and conceptualisation of the data
- Workability – refers to the integration of the categories into the core category that emerges
- Modifiability – ensuring that all the concepts that are important to the theory are incorporated into it by the constant comparison process. A modifiable theory can be altered when new relevant data is compared to existing data

Relative Merits of approaches

There are identified strengths and advantages, weaknesses and disadvantages to both qualitative and quantitative approaches. Table 3.1 below provides a simple overview and comparison of the key features of qualitative and quantitative approaches.

Qualitative method	Quantitative method
Emphasis on understanding	Emphasis on testing
Focus on understanding from the informants perspective	Focus upon facts and/or events
Interpretive approach	Logical and critical approach
Observations and measurements in natural settings	Controlled measurement
Subjective "insider view" of the data	Objective view, distant from the data
Explorative orientation	Hypothetical deductive; focus upon hypothesis testing
Generalisation by comparison of properties and contexts of individuals	Generalisation by population measurement.

Table 3.1: Features of qualitative and quantitative methods (Cited in Ross, A (2005) adapted from Cassel and Simon (1994))

The differing approaches have direct impact upon the structural design of the research projects and the potential existed to apply each approach at different stages of the project. Figure 3.3 illustrates the structural characteristics of the different approaches.

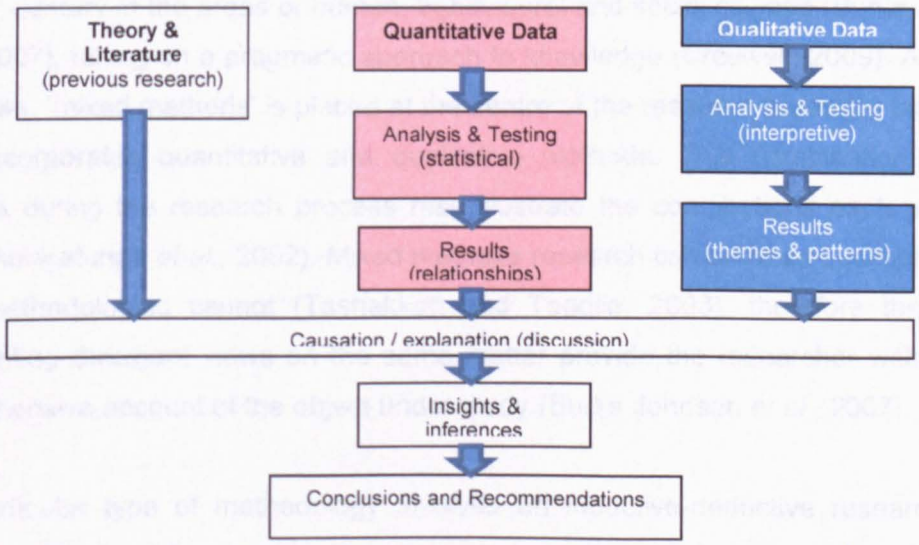

Figure 3.3: Structure of alternative research methodologies (adapted from Cotgrave 2008)

The nature of the research project was such that there were clear elements of the data that tended towards either qualitative or quantitative approaches at different stages of the work. The existing models applied to POE in Higher Education are heavily based on the use of questionnaires; the example identified, specifically within the research was the AUDE model, which was created in collaboration with HEFCE specifically for use in HEIs and which has been applied widely in educational buildings. This requires the application of quantitative methods of analysis. However, the gauging of stakeholder perceptions regarding the efficacy of the model and the identification of key factors affecting user satisfaction requires qualitative analysis. These factors justified a structure and approach to the project that utilized both qualitative and quantitative approaches in a mixed methods design.

3.2.3 Mixed Methods

The most recent type of research practice which is being recognized as the third research paradigm by some (Burke Johnson, Onwuegbuzie and Turner, 2007; Greene, 2008), mixed methods is a combination of both quantitative and qualitative methods (Teddlie and Tashakkori, 2009). While quantitative and qualitative methods have been more predominant in research, the mixed methods tradition emerged in the early to mid-20th century in the areas of human, behavioural and social science (Burke Johnson *et al.*, 2007), taking on a pragmatic approach to knowledge (Creswell, 2009). As Figure 3.1 shows, 'mixed methods' is placed at the centre of the research paradigm continuum as it incorporates quantitative and qualitative methods. This combination of both methods during the research process may illustrate the contributions each paradigm made (Amaratunga *et al.*, 2002). Mixed methods research can address questions which other methodologies cannot (Tashakkori and Teddlie, 2003); therefore the results representing divergent views on the same matter provide the researcher with a more comprehensive account of the object under study (Burke Johnson *et al.*, 2007).

This particular type of methodology involves an inductive-deductive research cycle which may be viewed as moving from grounded results such as facts and observations to inductive inference and to general inferences (theory, models, conceptual frameworks) through to deductive inference to predictions of particular *a priori*

hypotheses (Teddlie and Tashakkori, 2009). The end result, or justification for conducting MM research is that while both quantitative and qualitative methods have strengths and weaknesses, the weaknesses are compensated by the implementation of the other method (Amaratunga *et al.*, 2002) as the phenomena is looked at from various angles (Sale *et al.*, 2002).

Two approaches are recognised in the design of a mixed methods approach, integrated design and component design.

Integrated design: in this approach the data from the various methods inform the sampling approaches or measurement tools and mechanisms of the other. As work proceeds the data becomes merged iteratively and they are no longer distinct or recognisable in origin.

Component design: in this approach, the data retain their original form within structure of the project and the results inform the stages of the research sequentially. This approach has also been referred to as a 'two-phase' design (Cresswell, 1994). It is common for this approach to design to feature a dominant and a less dominant paradigm within it where the less dominant paradigm is applied to enhance or validate the results from the dominant paradigm. It also acts to support the weakness of a single paradigm by taking an alternative or dialectic perspective. (Ross, 2005)

Alternative descriptions for these two approaches to mixed methods design are parallel mixed design and sequential mixed design as set out below:

Parallel mixed design: Parallel mixed designs involve both quantitative and qualitative data to be collected simultaneously

Sequential mixed design: sequential mixed designs on the other hand can be used when data collection occurs in phases

(Teddlie and Tashakkori, 2009)

The structure of a mixed methods report may reflect the initial modes of inquiry that were used, that is, if the study began with a quantitative data which was followed on with qualitative efforts, the style of the report may be more oriented toward a standard quantitative publication. Conversely, if qualitative data was gathered first, the report may take on the free-form of writing (Creswell, 2009).

However, some critics of mixed methods wonder whether "the end product is more than the sum of the individual quantitative and qualitative parts" (Bryman, 2007; p. 8). For example, a sequential design may use quantitative methods after conducting qualitative ones in order to improve findings or to add some validity to the project, rather than integrating these two methods to genuinely get more rich and varied data. The way by which quantitative and qualitative methods are incorporated to look at different aspects of the same study is a process called triangulation (Amaratunga *et al.*, 2002). The term is used broadly to include multiple observers, methodologies and theoretical perspectives which assist in the mixing of methods. Sale *et al.* (2002) suggested that when a mixed methods approach is taken, it would be useful to distinguish what findings came from which adopted method. Not only does this show the contribution that each method made separately, but it enables the researcher to demonstrate that the findings of both quantitative and qualitative methods are assessing the same phenomena from different points of view. This ensures that the researcher engages with all of the collected data, rather than simply stating that a mixed methods approach was used to make a claim on ones capabilities to conduct various types of research.

It has been posited that caution should be exercised in the selection and application of a mixed method approach. Hammersley (1995) argues that the consideration of qualitative and quantitative methodologies simply as different techniques that can be combined to counter or negate each other's respective weaknesses neglects the 'different methodological arguments' associated with each and confines the potential of either of the approaches.

The approach taken to the design of the research project attempts to ensure that this is not the case and that each of the qualitative and quantitative components adopted retains the integrity of the underlying research paradigm.

3.3 Selected Approach: Mixed Methodology

It was necessary to make a decision regarding the most appropriate methodology to apply to the project to ensure that the intended outcomes could be achieved. This was, in part, constrained by the fact that the existing POE models in use are highly quantitative in nature, placing considerable reliance on questionnaires using Likert scales. Since such a model was being evaluated and compared within the study there was a clear requirement to apply quantitative approaches at defined stages of the study. However, the intention to identify and assess perceptions of building performance and the efficacy of these POE models relied on gaining insight into individuals' opinions. As such there was a strong drive to suggest the use of qualitative approaches for these elements.

Based on the foregoing and on a thorough review of the literature at hand on the three methodological approaches, and the research question being asked, a recommendation of using a mixed methods approach can be made. (Teddlie and Tashakkori, 2009) This is supported because the objective of the research topic is to understand POE from the point of view of the users and building procurers and operators as well as undertaking analyses of the outcomes of existing quantitative POE models. Solely relying on quantitative or qualitative methods would not be enough to address the research problem thoroughly enough, hence a pragmatic approach needs to be taken (Creswell, 2009).

Ornstein and Ono (2010) stated that:

"*drawing up a good questionnaire is always a challenge for research teams because there is no way to set up a standardized questionnaire that can be used to fit all case studies. Each case refers to different profiles of the population, with variations in age brackets, income strata and educational levels... Another obvious aspect is the care that must be taken in defining the population and sample of users to whom the questionnaire will be addressed*" (p. 54).

This statement strengthens the claim that a mixed methodology should be adopted as the strongest elements from both quantitative and qualitative methods can be selected

and used together in order to gain a more in-depth understanding of the building and its elements.

Researchers studying the POE process fail to mention the type of methodological approach which was used (Turpin-Brooks and Viccars, 2006); possibly because they prefer to discuss the work on a more practical or 'holistic' level than adhere to theoretical frameworks. Or perhaps it is because POE evaluation has been associated with using both quantitative and qualitative measures symbiotically (Preiser and Wang, 2008). There is also research highlighting the benefits of conducting POE within educational settings. Ornstein and Ono (2010) summarized the various settings in which POE could be conducted; they also assessed the performance of a school building by distributing age appropriate questionnaires to the pupils while also conducting focus groups, interviewing key persons. Watson (2003) conducted various evaluations on educational facilities such as technological centres, student accommodation and the overseeing of multiple school refurbishments. Engaging building users with these evaluations and conducting walkthroughs for problems and suggestions to be voiced was paramount in being able to rectify any shortcomings and build a best practice portfolio for similar projects.

Raftery et al (1997) advocate mixed methodology as a pragmatic approach to built environment research, stating that both qualitative and quantitative approaches offer valid methodologies, with neither being superior to the other. It is suggested that researchers within the built environment disciplines should undertake research by applying the most appropriate method to a defined research problem from an unconstrained and wide range of possible approaches.

This view is supported by various commentators, including Morse (1991), Csete and Albrecht (1994) and Amaratunga (2002) who comments:

> *"I do not want 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 the work."

The validity of mixed methodology is established and accepted by built environment researchers, provided that there is recognition that the selected approach is driven by the requirement to use the most appropriate model to address the defined research question. As such the adoption of a mixed methodology approach was considered to be appropriate for the study.

Various differing approaches exist to the application of mixed methodology for the collection and analyses of data. There is an important distinction between studies that use a 'mixed method' approach and those that use a 'mixed model' approach. This is summarized in table 3.2 below:

Mixed Method Approach	**Mixed Model Approach**
Combine qualitative and quantitative approaches in single or multi-phased study. Qualitative and quantitative approaches regarded as relatively independent. Triangulation techniques used to link phases	Combine qualitative and quantitative approaches within different phases. Qualitative and quantitative approaches interwoven in different ways; single application on different phases or used simultaneously on same phase.(Niglas 2000) Triangulation techniques potentially used

Table 3.2: Features of mixed method and mixed model research approaches

In this study the mixed method approach has been applied with both qualitative and quantitative approaches to data collection and analysis used at various stages with triangulation of the various data. The buildings that were selected as the setting for the research were subject to real time environmental monitoring through a sophisticated 'Trend' data logging and Building Management System (BMS). As such they afforded the author the possibility of gathering environmental data that could be triangulated with the data derived from occupant surveys regarding perceptions of the various IEQ factors. Whilst this could provide an interesting body of data it was decided not to incorporate it within the study. for the following reasons. Firstly, the purpose of the study was to evaluate the efficacy of the AUDE POE questionnaire in measuring the factors

that influence user satisfaction, not to assess the performance of the building per se. Hence, the introduction of the potentially large data set would have been tangential to the main thrust of the work. Secondly, the various other elements of qualitative and quantitative data collection tools were used discretely and their results triangulated in a mixed methods approach. The utilisation of this data interwoven with qualitative data would have made the selection of a mixed method approach less clear and would have added little to addressing the main research questions posed within the project. In deciding the most appropriate approach to each stage of the project to ensure the most valid and reliable outcomes reference was made to the flow chart illustrated in figure 3.4, which sets out the decision making considerations for each stage of the project.(Naglis 2001)

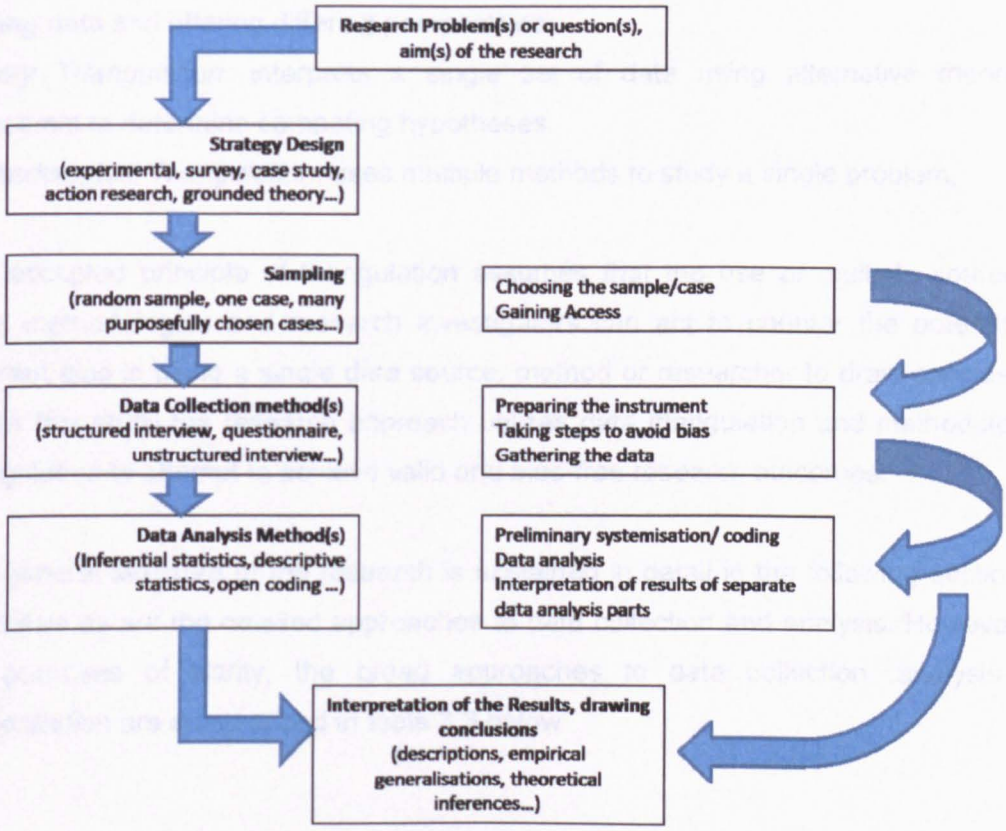

Figure 3.4: Methodological Decisions and Practical Steps (Naglis, 2001)

The application of a mixed model approach to the study incorporated the use of triangulation to attempt to counter the potential weaknesses of each of the individual methods incorporated within the various phases of the study. The principle of triangulation within built environment research is recognised to mean the combination of alternative methodologies in the study of the same phenomenon aimed at compensating for the potential weaknesses of a single methodology.(Amaratunga 2002) Alternative forms of triangulation have been identified based on the perspective and purpose of the research study and the methodologies adopted. These are posited by Denzin (1970, 1989) as:

Data Triangulation: various data sources and data sets are used within a study, which may be qualitative or quantitative, gathered by the same, or different methods
Investigator Triangulation: based on contributions from several different researchers pooling data and offering differing perspectives.
Theory Triangulation: interprets a single set of data using alternative theoretical viewpoints to determine competing hypotheses.
Methodological Triangulation: uses multiple methods to study a single problem.

The accepted principle of triangulation assumes that the use of multiple sources of data, methodologies and research investigators can act to counter the potential for inherent bias in using a single data source, method or researcher to draw conclusions. Within this study the research approach utilizes data triangulation and methodological triangulation to attempt to achieve valid and bias-free research outcomes.

The general structure of the research is explained in detail in the following sections of the thesis as are the detailed approaches to data collection and analysis. However, for the purposes of clarity, the broad approaches to data collection, analysis and interpretation are summarized in table 3.3 below

	Data Collection	Analysis
Phase 1	Literature Review	Thematic review of existing literature to develop insight and identify potential for research topic
	Exploratory Interviews with Directors of Estates: Qualitative	Qualitative analysis of responses undertaken using NVIVO to validate appropriateness of research topic
Phase 2	AUDE POE Questionnaires: Quantitative	Statistical analysis of questionnaire results using SPSS to generate descriptive and interpretive statistics aimed at testing the robustness of the model and identifying significant variables that impact upon user satisfaction.
	AUDE Questionnaire free text comments: Qualitative	Qualitative analysis of responses undertaken using NVIVO to categorise comments from building users and identify themes and trends associated with factors affecting perceptions of satisfaction
	Semi-structured interviews with Directors of Estates: Qualitative	Qualitative analysis of transcripts undertaken using NVIVO to categorise comments from DoEs and identify themes and trends associated with perceptions of purpose and efficacy of POE models in HEIs
	Focus Groups with Building Users: Qualitative	Qualitative analysis of transcripts undertaken using NVIVO to categorise comments from building users and identify themes and trends associated with factors affecting perceptions of satisfaction
Phase 3	Focus Groups with Building Users: Qualitative	Qualitative analysis of responses undertaken using NVIVO to validate appropriateness of content of proposed POE model
	Semi-structured interviews with Directors of Estates: Qualitative	Qualitative analysis of responses undertaken using NVIVO to validate appropriateness of content and application of proposed POE model

Table 3.3: Project Phases: Data collection and analysis

The following sections set out the conceptual framework for the project and the final research design, which is based on the mixed method approach that has been discussed and justified within the preceding paragraphs. One of the key qualitative components of the work was the use of interviews, which feature in all 3 phases of the project. However, the nature and function of these varied between phases as indicated in table 3.4 below.

Stage	Interview purpose	Interview form
1	Assessing validity of the research topic	Exploratory open
2	Gathering qualitative information regarding users' experience of quantitative. POE models	Hypothesis testing Semi-structured
3	Validity outcomes of stages 1 & 2 research	Validity reflective semi-structured.

Table 3.4: Purpose and form of interviews within the project

In order to ensure that the interviews used within the qualitative parts of the study were appropriately focused and directed to the core purpose of the study a process of reflection and clarification was necessary. The background knowledge of the subject matter was derived from the literature review and supported by the 3 validation interviews undertaken in stages 1 of the study. These elements combined to provide a scope or definition of what was to be studied. Within this part of the work it was essential to clarify the exact purpose of the interviews in order to ensure that they provided the appropriate information to assist in deriving valid consideration of the initial hypothesis.

3.4 Overview of Conceptual Framework of the Research

This section sets out the research design and the framework within which the project was undertaken. The foregoing discussion and justification of the mixed method approach to the research was developed to construct a research framework for the project that identified three discrete stages or phases of the work. The work associated with each of these stages was undertaken in a sequential manner so that the later stages of the work developed logically from the foregoing stages and that evolving data and analysis informed progress of the project.

The first phase of the work sought to establish the background and context to the project and to provide insight in to the current knowledge base relating to POE in Higher Education institutions. It was used to establish the potential for the research work to constitute a valid basis for PhD study with the potential for the development of original contribution to knowledge. This part of the project incorporated a detailed literature review, together with the use of a simple questionnaire aimed at establishing the existing landscape of the application of POE and the application of semi-structured pilot interviews. The outcomes of the first stage were used to refine the structure of the project and to inform the methodological approach to the study.

The second phase of the work sought to establish and test the hypotheses that underpinned the work. This stage included the gathering and analysis of data from qualitative and quantitative sources together with the discussion and triangulation of the outcomes of the analysis to draw conclusions relating to the hypotheses. Within this stage the AUDE questionnaire was used to gather data relating to users' perceptions of satisfaction associated with two buildings that were selected as the research environments for the project. Building users also participated in a number of semi-structured focus groups to provide a deeper level of insight regarding their perceptions of the factors affecting satisfaction. This phase of the work also featured the use of semi-structured interviews with Directors of Estates, which were intended to provide an understanding of their experiences in using POE and their perceptions relating to the factors that influence user satisfaction in Higher Education buildings.

Each of the first two phases was designed to address specific aims of the research and to use the resulting outcomes to enable the valid progression to subsequent phases of work.

The final phase of the work used the outcomes of the first two stages to allow the development and validation of a proposed, refined POE model. The model that was developed was subject to commentary and validation through the undertaking of further focus groups with building users and through structured interviews with Directors of Estates.

Figure 3.5 illustrates the structure of the project and the components of each of the defined phases or stages.

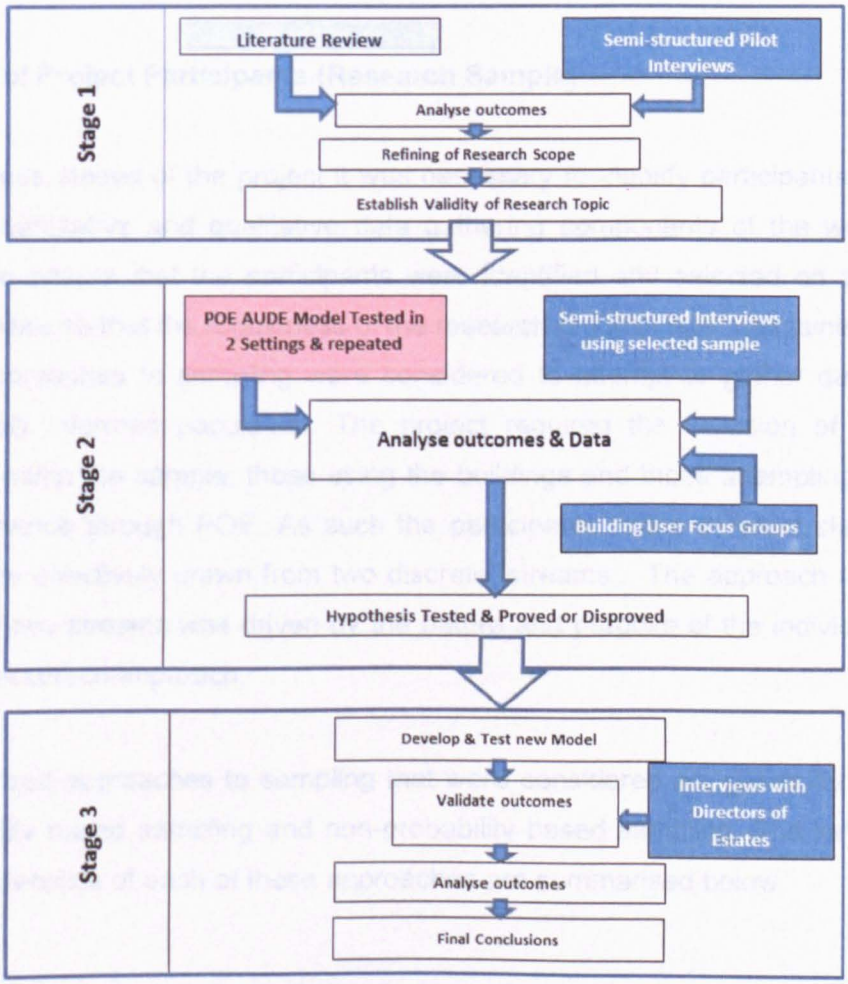

Figure 3.5: Structure of the research project

Approach to the Study

The study began by attempting to identify who the major stakeholders in the context of the use and occupancy of buildings in Higher Education Institutions (HEIs). The intention was to identify the factors that influence perceptions of overall satisfaction of building users; going further to compare these with the perceptions of building operators, regarding the factors that affect user satisfaction.

The groups identified were as follows:

- Building users: represented by students and staff
- Building operators: represented by Directors of Estates or similar

Selection of Project Participants (Research Sample)

At the various stages of the project it was necessary to identify participants to engage with the quantitative and qualitative data gathering components of the work. It was essential to ensure that the participants were identified and selected on a valid and objective basis so that the robustness of the research process was maintained.
Several approaches to sampling were considered to attempt to gather data from an appropriately informed population. The project required the inclusion of two broad groupings within the sample; those using the buildings and those attempting to assess user experience through POE. As such the participants in the different stages of the project were effectively drawn from two discrete 'streams'. The approach to sampling from these two streams was driven by the nature and purpose of the individual project stage and research approach.

The two broad approaches to sampling that were considered are generally referred to as probability based sampling and non-probability based sampling. The key attributes and characteristics of each of these approaches are summarised below.

Probability based sampling: this approach attempts to represent as far as possible the random distribution of a population within the research sample and may be effected using:

- Simple random sampling
- Systematic sampling, based on selection at regular intervals randomly from a population or sample group
- Stratified sampling, based on selection of non-overlapping groups within a population
- Cluster sampling, selecting clusters from within the population based on some defined attribute such as geographical location

Non-probability sampling: this approach does not seek to replicate the random distribution of a population set but instead adopts a directed selection of sample that may be based on a variety of selection criteria. This approach may be based on a number of accepted selection techniques such as:

Convenience sampling; based on the inclusion of easily accessible samples often drawn from volunteers. It is generally accepted that this approach has potential for bias as a consequence of the likelihood of non-representative distribution of self-selected participants.

Purposive sampling; which adopts an approach in which specific participants or groups are sought out that fit predefined criteria for selection.

Theoretical or Expert sampling; which adopts an approach based on the selection of participants that are in the best position to ensure that the questions posed are answered with an appropriate degree of base knowledge or contextual certainty. This relies on the participants being in possession of suitable specialist knowledge and understanding of the research context.

Snowball sampling: this approach adopts a model in which a small number of participants are chosen initially, which then link to others and identify others potential participants such that the sample takes on a cumulative 'snowball' effect.

Proportional Quota sampling: which is based upon selection of a sample proportion with given characteristics up to a defined quota. The opposite approach to this is the adoption of non-proportional quota sampling.

Based on a consideration of the potential benefits and dis-benefits of each of the alternative approaches a sampling process was adopted for the research that reflected the different groups that were involved at each of the stages of the work.

The participant groupings were established as follows:

Participant Grouping	Context	Knowledge base	Perspective
HEI Estates Managers/Directors	Building procurers and operators. Commissioners and stakeholders in POE process.	Technical knowledge of building form and function. Knowledge of impact of building form upon function.	Building procurers Building Operators Budget/account holders Building as part of larger estate Accountable to institutional governance structures
HEI Building Users (Staff)	Building Users; long term occupants and operators of local facilities	Local knowledge of building functionality and characteristics. Awareness of impact of building features on personal role and function.	Regular/long term building users Building as workplace and social space Individual and team member Personal Space within building identifiable
HEI Building Users (Students)	Building Users; short term and transient user group.	Local knowledge of parts of building based on intermittent occupation. Awareness of impact of building features on personal and peer experience.	Intermittent building users Building as study and social space Building user as peer/community member

Table 3.5: Participant Groupings within the Project

The samples for each of these participant groups were selected using a staged process that reflected the overall populations and the required sampling frames. The purpose of

the various samples was also taken in to account, together with the nature of the research tools applied at the different stages of the project. The various approaches taken to the selection of appropriate research samples is discussed in detail within the following sections that relate to specific components of the research.

The following chapters provide a detailed explanation of the structure and framework of the project within the various stages of the work. In addition they set out the approaches taken to data collection and analysis together with discussion of the outcomes.

3.5 Overview of the Research Setting

Both of the buildings that were included within the study are located within the estate of Liverpool John Moores University. They were selected for inclusion within the study because they displayed a number of characteristics that allowed them to be considered as sufficiently similar to make observations and comparisons regarding their performance valid within the research. They each fulfilled key criteria for selection as follows:

- they were new buildings completed in the last five years.
- they were designed specifically for use as educational buildings within a university environment.
- they each include a range of facilities for classroom teaching, laboratory and workshop activity, staff accommodation and ancillary space.
- both buildings involved user participation in the initial design process
- The users sets for each of the buildings was broadly similar in terms of scale and structure

As a result of the foregoing the two buildings were considered to be appropriate for incorporation within the study. The selected buildings were :

- The Liverpool Art & Design Academy (ADA)
- The Tom Reilly Building (TRB)

Liverpool Art & Design Academy

The Art & Design Academy building was designed with the intention of providing new accommodation for the Faculty of Arts, Media and Professional Studies. The intention was to provide a new building designed around the needs of the faculty, with the intention of relocating staff, students and facilities from the existing Victorian buildings that they previously occupied. As part of the process a detailed user consultation was undertaken to inform the design process. This was referred to as the 'Edge' project and is outlined below.

The *Edge Project* was set up within Liverpool John Moores University to develop a plan for a new Liverpool School of Art and Design. In January 2004, the Steering Group reported to the then Vice Chancellor setting out:

A Vision for the new School of Art & Design.

> *A strategy to deliver a new purpose built facility that would support a distinctive brand, an enterprise culture, and a robust academic structure.*
> (Brickwood 2004)

The result of the consultations surrounding the EDGE project was a commitment to commission the design and construction of a new building to house the various existing Schools that would be combined in a new School of Art and Design.

A key part of the EDGE project was the undertaking of extensive consultation with staff and students to inform the design brief for the new building.

Appendix 1- provides illustrations of the completed building and a schedule of accommodation.

Construction of the new building commenced January 2007 and finished in July 2008. The completed building was occupied and in full operation for the 2008/2009 academic year.

The building provides accommodation on three floors including teaching rooms, a large auditorium, display spaces, meeting rooms, workshops, staff accommodation and a cafeteria. The accommodation is summarised in appendix 1.

Tom Reilly Building

The Tom Reilly Building was designed to provide accommodation for the Faculty of Science, Construction commenced in 2008 and the completed building was occupied

with full operation for the 2009/2010 academic year. The intention was to provide purpose built accommodation for the faculty to cater for increased demand and growing use of the Byrom Street campus. The space provided allowed for the rationalisation of the location of the faculty to bring together previously disparate areas of activity. The accommodation was subject to user consultation prior to the design process through the creation and operation of a 'building users' group and a capital project board.

Appendix 1 provides illustrations of the completed building.

The building provides accommodation on five floors and includes teaching rooms, laboratory facilities (including the sports science running track), meeting rooms, staff rooms and ancillary spaces. The accommodation is detailed in appendix 1.

Both buildings provide accommodation that is departmentally specific. However, both also are intended to provide for generic teaching accommodation that is timetables centrally and is intended to be used by students and staff from across the University. As such they provide research settings that could be considered broadly similar and appropriate for consideration and comparison within the research.

4.0 Overview of Current Practice: Pilot Phase

4.1 Introduction

This chapter sets out the details of the pilot phase of the study which incorporates elements of both quantitative and qualitative analysis. The aim of the pilot phase was to establish the validity of the selected topic as a basis for PhD study and to refine the hypothesis. This phase also allowed the author to refine the scope of study to be undertaken in the main phase of the research.

4.2 Research Design

Stage 1: Research Landscape and Pilot Study

The primary aim of Stage 1 of the project was to establish the validity of the topic area as a subject for the research. Accordingly the following objectives were established:

- To establish the current situation concerning the acceptance and utilisation of POE in UK Higher Education Institutions.
- To gain insight into the experiences of those applying POE, in a wider context, and to understand the current industry attitudes towards the various models in use.
- To appreciate the various drivers and inhibitors to the use of POE as a tool for building improvement.
- To establish the validity of the UK Higher Education sector as a suitable environment for the research.

In order to address these objectives a series of research questions was developed for the first phase as follows:

- is the process of POE understood and applied consistently in HEIs?
- do those who have experience and POEs feel that it is an effective and consistent tool for supporting user satisfaction in HEI buildings?
- what is the basis of the currently utilised models – qualitative and quantitative?
- what is understood to be the purpose/aim of doing POEs?

The first phase was essentially a pilot study that built upon the detailed literature review to clarify the extent to which the proposed research topic provided a valid basis for PhD study. The insight and knowledge developed from the literature review was supplemented by data aimed at assessing the level of understanding of POE within the research setting and the extent to which it has been applied. In addition it was intended to gain preliminary insight in to the perceptions of potential POE users regarding the usefulness and efficacy of the process. Accordingly, in addition to the literature review, data was gathered using two mechanisms:

Through the use of a simple questionnaire distributed, electronically, to all Directors of University Estates within HEFCE funded institutions to gauge the extent to which they were aware of POE and, if so, whether their experience had been positive, negative or mixed.

By undertaking exploratory, semi-structured, interviews with a small pilot sample of Directors of Estates to gain deeper understanding of their awareness and experience of POE.

The questionnaire aimed to provide data on the current level of awareness and understanding of POE within the HE sector, together with appreciation of the extent to which it has been perceived as successful by its users. It also provided a mechanism by which the author could categorise and select potential candidates for participation in later, more detailed stages of the research.

The interviews with a sample group of Directors of Estates aimed to fulfil three functions. Firstly, to identify the extent of knowledge and understanding on the part of potential users of the purpose and process of POE. Secondly, to gather data relating to their attitudes towards the process of POE and their perceptions of its importance and efficacy. Thirdly to provide a process to pilot questions for use within semi-structured interviews to be used within Phase 2 of the project.

The first stage of the research also sought to identify and define the research sample that would be used for initial targeting within Phase 1 and which would be refined as the basis for the subsequent stages of the project.

Components of the 1st Stage

The components of the pilot stage (stage 1) of the research project are summarised in table 4.1 below.

Component	Purpose	Approach
Literature Review	Establishing existing knowledge base relating to POE and user satisfaction	Literature Review
Landscaping questionnaires	Gauging extent of experience and use of POE within HEIs. Establishing Research sample	Quantitative
Pilot Interviews	Validating research topic and piloting research interview form for stage 2 of the work.	Qualitative

Table 4.1: Components of the pilot stage of the project

The Pilot stage of the project was informed by the literature review and comprised two components of data collection and analysis; firstly the use of a simple 'landscaping' questionnaire and, secondly, the use of pilot interviews. This first phase of the research was undertaken with the intention of establishing whether the scope and context of the proposed work were valid.

The literature review supported the notion that POE can be a valuable and effective tool for the measurement and enhancement of building performance. It also illustrated that it is well established within property and facilities management practices and within the specific research context of Higher Education buildings. However, the specific element of user satisfaction was identified having variable degrees of application and success. The potential conflict between the aspirations of those applying POE and the results that are liberated from the process was recognised. In addition, the tendency to focus

on physical building performance and characteristics of project delivery that may be used to draw conclusions regarding project 'success' was identified. Notwithstanding these issues, it was recognised that the various models of POE that are in common usage also seek to assess user satisfaction through a range of quantitative and, to a far lesser extent, qualitative analyses. In practice, the majority of the models cited rely heavily and in some instances, exclusively, upon the quantitative analysis of data liberated using questionnaires. One of the most commonly applied models used within HEIs was identified to be the AUDE model, which was developed specifically for use in HEIs.

Taking these outcomes from the literature review, the pilot stage was structured so as to gain a more specific appreciation of the extent to which POE is applied, understood and considered to be effective in the current context of HEIs in England and Wales. The two components selected to support this were identified as follows:

Landscaping questionnaire: distributed to all HEIs within the selected population set and intended to provide an overview of general awareness of POE and level of utilisation and perceived effectiveness in HEIs

Pilot Interviews: undertaken with a small, selected group of Directors of Estates from the sample population and intended to provide deeper insight in to issues surrounding the application of POE, its perceived purpose and efficacy on the part of building operators.

4.3 Analysis and Discussion of Data

Landscape Overview Questionnaires

Participants in this component of the research were identified through a process of theoretical and expert sampling. Directors of Estates of HEFCE funded HEIs were included in the main research population based on their inclusion in the AUDE list of Directors of Estates for HEIs within the UK. This list was filtered to remove any potential participants that did not meet certain criteria for inclusion (these are discussed in a later section) .An electronic questionnaire was then circulated at all members of this group

incorporating a series of simple questions aimed at assessing the extent to which POE is used, understood and valued within individual HEIs.

The stated aims of the project are highly specific to the context and environment of Higher Education institutions in the UK. As such the population for inclusion within the research was identifiable through the application of a set of simple criteria. It was recognised that the research design necessitated the inclusion of respondents from different stakeholder groupings in order to allow the effective gathering, analysis and triangulation of data. The population was divided in to discrete participant groupings based on context, knowledge base and potential perspective on the research problem.

The potential population set for HEI Estates Directors was defined by the inclusion of all of the role holders identified as 'Head of Estates' or equivalent by the Association of University Directors of Estates (AUDE). The resultant list included 156 members, representing all institutions included within the public Higher Education sector in the United Kingdom. In order to refine this grouping and to ensure that the population set was appropriate to the defined research questions the list was filtered to remove inappropriate inclusions.

The POE model that was selected as exemplifying the application of POE within HEIs was the AUDE/HEFCE model that was developed specifically for use in HEIs. However, since this model was commissioned by HEFCE and differs from models applied in Scotland and Northern Ireland it was appropriate to exclude Scottish and Northern Irish institutions from the initial population set. Hence, those institutions outside of England and Wales were excluded from the list. In addition, those institutions that were characteristically unusual to such an extent that they were unrepresentative of HEIs were removed from the population set.

As a result 42 institutions were removed from the list of potential participants in the research . These are summarised as follows:

Scottish & Northern Irish Institutions (non-HEFCE funded)	17
Non-typical Institutions (includes Teaching Hospitals,	

Open University, Natural History Museum, Heythrop College etc) 25

The resulting potential population set was 114 Institutions, distributed as shown in table 4.2 below.

UK Region	HEI Pre 1992 University	HEI Post 1992 University	HEI Non University	Total HEIs
Wales	5	5		10
England	41	55	8	104

Table 4.2; Distribution of HEIs in the population set

The questionnaire was distributed to Directors of Estates, or equivalents, in each of the institutions that was included within the final sample frame. This equated to 114 institutions in total all located within England and Wales. The primary purpose of the questionnaire was to gauge the level of awareness and experience of POE on the part of the Directors of Estates. However, it was also utilised as a mechanism to assess the potential for their inclusion in the later, more detailed stage of the research project.

Four questions were posed, based on yes/no/partially response options, to assess the level of experience and satisfaction with the POE process, supported by one supplementary question to identify any specific POE model that had been used. The responses to these questions defined the sampling frame for this part of the project. The questions were as follows:

Are you aware of the process of POE? *Yes/No*

Have you undertaken major capital projects in the last 4 years? *Yes/No*

Have you used POE in relation to a capital project(s)? *Yes/No*

If yes; what model did you use?

Did the process of POE deliver what you wanted from it?

Yes/No/Partially

The responses to these questions were used to formulate an overview of the current state of knowledge and application of POE within HEIs and to inform the second stage of the sampling.

Of the initial 114 institutions included within the list, responses were received from 31, indicating a response rate of around 27%.

The questionnaires were reviewed to allow the development of clusters of respondents within each of four distinct groupings of institutions as follows:

- Capital projects undertaken in last 4 years but not used POE
- Capital projects undertaken in last 4 years. POE used successfully delivering intended outcomes
- Capital projects undertaken in last 4 years. POE Used without successfully delivering intended outcomes
- Capital projects undertaken in last 4 years. POE used with partial success in delivering intended outcomes

These clusters and the details of the respondents falling into each are illustrated (anonymised) in figure 4.1 below. Full details are included in appendix 2

Capital projects in last 4 years. POE used with partial success in delivering intended outcomes **1** **2** **3** **4** **5** **6** **7** **8** **9** **10** **11** **12** **13**	**Capital projects in last 4 years. POE used successfully delivering intended outcomes** **15** **16** **17** **18** **19** **20** **21** **22** **23** **24** **25** **26**
Capital projects in last 4 years but not used POE **27** **28** **29** **30**	**Capital projects in last 4 years. POE Used without successfully delivering intended outcomes** **31** **32**

Figure 4.1: Project sample cluster analysis

The responses indicated that from those who returned the questionnaire:

- 4 institutions had not taken the opportunity to utilise POE on projects that had been undertaken
- 13 institutions had partially achieved what they had intended as outcomes of the POE without success or with limited success.
- 12 institutions had achieved what that had intended as outcomes of the POE process.
- 2 institutions had conducted POE but had not achieved successful outcomes

These results are illustrated in Figure 4.2 below

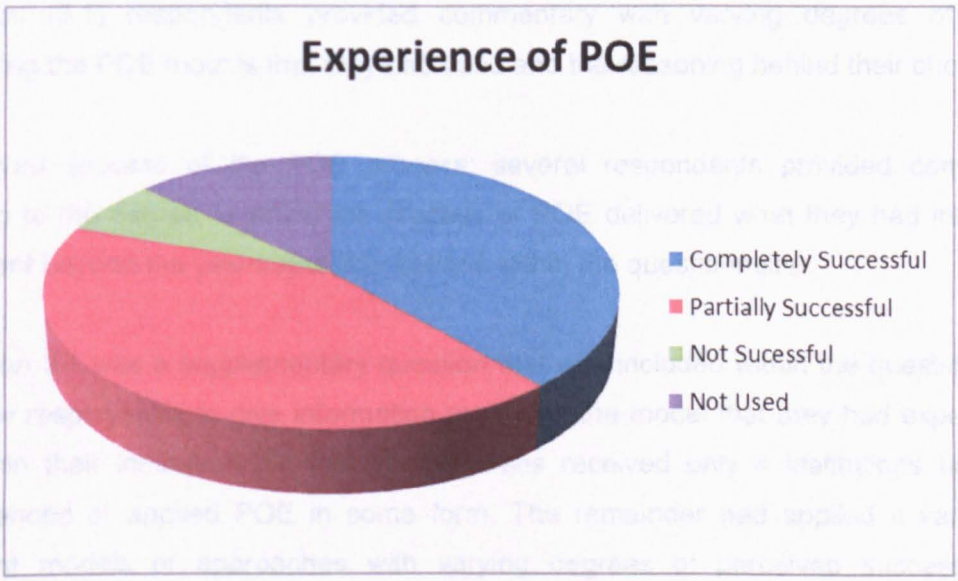

Figure 4.2: Experience of using POE in HEIs

This suggests that POE had been utilised with completely successful outcomes in 38% of potential instances.

Supplementary commentary

The questionnaire was intended to provide the participants with the opportunity to give simple yes/no/partially responses to the main questions, with the capacity to define any models of POE that they had experience of in the supplementary question. However, several of the respondents went further and provided qualitative comments relating to their experiences in using POE and the nature of the models that they had applied. These elements of commentary provided a further component of analysis within the pilot stage that provided useful further insight in to the perceptions of project participants regarding the use and efficacy of the POE process. The comments fell in to two broad categories as follows:

Models of POE applied: within the scope of their responses to the supplementary question (3.1) respondents provided commentary with varying degrees of detail regarding the POE models that they had used and the reasoning behind their choices.

Perceived success of the POE process: several respondents provided comments relating to the degree to which the process of POE delivered what they had intended that went beyond the yes/no/partially options within the questionnaire.

Question 3.1 was a supplementary question that was included within the questionnaire to allow respondents to give information regarding the model that they had experience of within their institution. Of the 31 responses received only 4 institutions had not experienced or applied POE in some form. The remainder had applied a variety of different models or approaches with varying degrees of perceived success. The responses are summarised in the table below, with direct quotations extracted from the response received. The responses are anonymised although details are included in appendix 2.

Institution	Model used	Fulfilled requirements?
1	Informal workshop run by the PM with stakeholders, contractors and consultants	partly - indicated some key issues for improvement or incorporation
2	internally prescribed process not industry adopted.	provides sufficient information for our needs
3	Full report attached	SEE FULL REPORT
4	Bespoke	Partly
5	independent external review by means of stakeholder interviews	To a limited degree
6	AUDE amended	partly -
7	Broadly based on HEFCE model	Difficult to comment, as it will really only become apparent when we start the next project.
8	we use an external consultant to carry these out	I would state that the POEs have been successful, however not always
9y	No model used	Y
10	AUDE amended	partly -
11	BRE and internal assessors	we are looking to improve outcome of Post Occupancy Evaluation
12	Bespoke	To a limited extent
16	hybrid model based loosely on AUDE	Broadly it does
17	Bespoke developed with consultant and contractor team	YES – it gave us a lot of information to carry forward into next project
18	model that was based on the HEFCE guidance with input from consultant to develop suitable model for our use.	We have produced POE improvement plans
19	Survey/questionnaire	Yes
20	very simple 'user based' methodology	Yes
21	AUDE	Yes
22	Variation on HEFCE Model	Yes
23	Bespoke	Yes
24	Funding Council advice was followed	Yes
25	Developed a hybrid model to match our specific needs	YES; prompted changes to procedures and more robust room data sheets amongst other issues.
26	Own variant	Yes
27	Bespoke	Partially.
28	aim to finalise bespoke POE process by the end of this year	In part
29	no specific model used, undertaken by external consultants	it could have been better!
30	AUDE /Hybrid	Mixed, but generally no.

Table 4.3: Responses to supplementary questions

These responses were reviewed to establish the degree to which the models identified could be considered as bespoke to a given institution or project and the degree to which the AUDE model, or some other standardised model was applied. In this context the term bespoke appears to be used by participants to refer either to models of POE that

are essentially tailor made for individual instances or those that are tailored for use by hybridisation of existing models. As far as possible this is interpreted by the author based on the context and nature of the specific commentary. In addition the extent to which the outcomes of the process were considered to have been successful in the eyes of those applying the POE was noted. The outcome of this review process was translated manually in to a simple quadrant, scatter diagram based on the author's interpretation of the statements made within the full responses received from the participants. The use of the scatter diagram, illustrated in figure 4.3, allowed the visualisation of the distribution of responses relative to the nature of the models employed and the perceived success level of the models. Whilst it is not possible to plot the positions of each respondent within the quadrants exactly the comments do allow broad positioning for illustrative purposes. The diagram is not intended to represent a definitive, quantitative graph. It is intended to position each of the responses within a broad landscape based on extent of qualitative comments relating to POE form and perceptions of success.

The diagram shows a relatively strong tendency towards the use of custo-made models of POE rather than the use of standardised models such as the AUDE approach. 17 of the respondents indicated that they adopted custom-made models for POE. It also illustrates that the use of the AUDE and other standard models is subject to amendment or hybridisation, with very few examples of the model being adopted without some form of amendment.

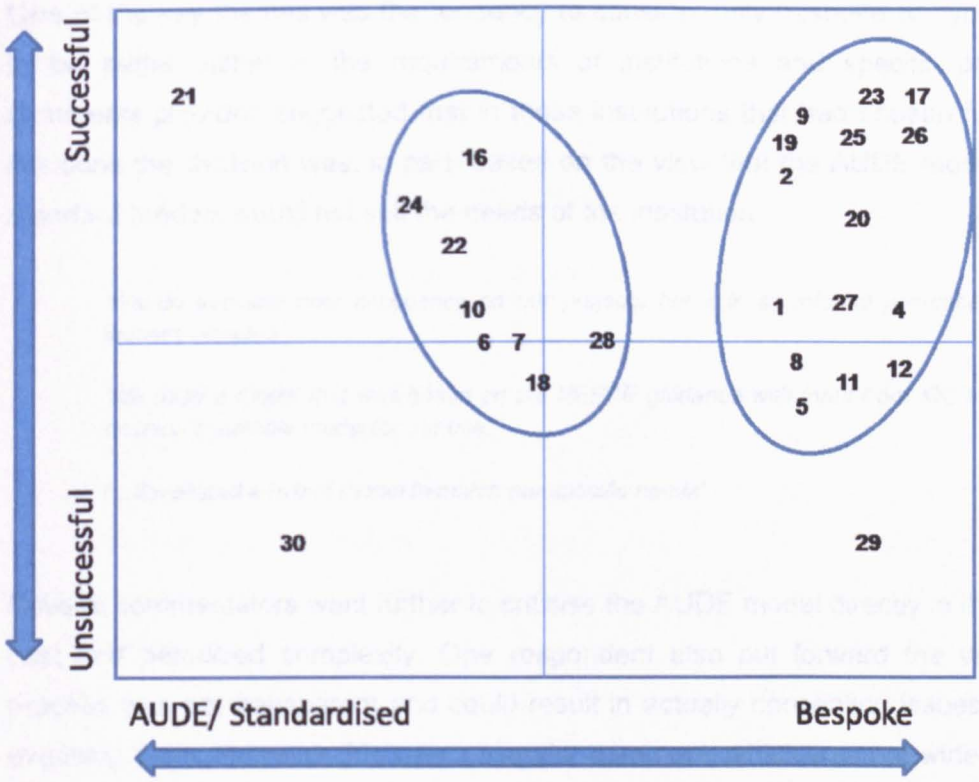

Figure 4.3: Scatter diagram

Two clusters are visible, showing that both bespoke (custom-made) and standardised models liberate a range of results indicating successful or partially successful outcomes, with three outliers representing single instances of the unsuccessful use of each of the approaches and a single instance of the successful use of the AUDE model in un-amended form. The scatter diagram suggests that, whilst POE is being conducted with differing degrees of satisfaction, there is reluctance on the part of those applying it to adopt the AUDE model or other established standardised models. There is also a suggestion that custom-made models have been applied, successfully, more frequently than the AUDE and other standardised models. However, the two instances of POE that were identified as being entirely unsuccessful comprised of one example of each, a custom model and the AUDE model. Within the comments that were provided there were several key themes, which suggested that the Directors of Estates had established perceptions regarding the use of POE.

One of the key themes was the tendency to consider fully bespoke or hybrid solutions to be better suited to the requirements of institutions and specific projects. The comments provided suggested that in those institutions that had chosen fully bespoke solutions the decision was, in part, based on the view that the AUDE model and other standard models would not suit the needs of the institution.

> *'We do evaluate post occupancy on our projects but it is an internal prescribed process not industry adopted'*
>
> *'We used a model that was based on the HEFCE guidance with input from XX, as consultant to develop a suitable model for our use.'*
>
> *'...developed a hybrid model to match our specific needs'*

Several commentators went further to criticise the AUDE model directly in the context of cost and perceived complexity. One respondent also put forward the view that the process was not transparent and could result in actually concealing issues rather than exposing them. However this was a singular comment, which was not widely voiced. In general the benefits of doing POE were recognised but cost and users' perceptions of complexity were seen as inhibitors.

> *'the HEFCE model prevents honest and open dialogue; in my view it can become a mutual appreciation society with the key issues swept under the carpet. It can be expensive, the use of a good facilitator is key'*
>
> *The AUDE methodology is fantastic, if you have many £000's to spend on a POE. We didn't, and did not wish for such an involved process.*

The apparent preference for fully bespoke, or custom-made models was linked to concerns that POE could be overly complex as well as costly to deliver. Several respondents cited the issue of simplicity as a key factor in their selection and application of an appropriate model. There was a strong linkage between perceived simplicity in application and perceived success of the selected model. There were several references to suitability for individual needs and fitness for purpose of the chosen model. These suggested a linkage between fitness for purpose and the avoidance of over complex approaches to the POE process.

More recently we have gone for a less formal workshop run by the PM with, us, stakeholders, (students and staff) contractors and consultants-

We used a very simple methodology..... We just had a very 'user based' methodology - at the end of the day, we just needed to know what the users felt, whether they considered it to be a usable building, and to take some lessons (good and bad) forward to future projects.

our internal evaluation provides sufficient information for our needs

Respondents commented, positively, about the perceived success of the model chosen in 13 instances. There were mixed or neutral comments that contained positive elements in a further 6 instances. Within these responses there were several factors that appeared to be significant in influencing perceptions of the success of the POE process. The most common factor that was identified in this regard was the process improvement resulting from the development of knowledge on one project feeding forward to subsequent projects. None of the respondents commented upon the benefit of POE as a tool for managing building performance in real-time; all positive comments related to either feed forward processes or benefits in stakeholder engagement in the design process.

'... it gave us a lot of information to carry forward into next project'

YES; prompted changes to procedures and more robust room data sheets amongst other issues.

it will really only become apparent when we start the next project.

There were also negative comments in 5 cases relating to the potential for applying the outcomes of the POE process in such a way as to liberate tangible benefits. There was a body of opinion that suggested that, whilst POE has clear and valuable benefits, it is difficult to liberate these due to the individual nature of each project or contextual situation. This was seen as both an inhibitor to the effective application of the process and as a driver towards the use of fully bespoke solutions rather than the adoption of the AUDE or other standardised model.

' I am very interested in the concept of soft landings, continual monitoring following completion and on-going review and evaluation of occupation post PC - however the reality is often more difficult to implement.

' I always hoped POE would drive continual improvement of a completed building, however quite often the process of passing capital project to an operational team means that lessons learnt through POE are not implemented.

"I would state that the POEs have been successful, however the vagaries of different design teams and the ability to determine input into the scheme does mean that the potential to apply all learned outcomes from previous POEs is not always entirely possible!'

Clearly, the foregoing discussion raises questions regarding the level to which such models are considered to be appropriate or fit for purpose by their potential adopters and tends to support the consideration of this area as an appropriate basis for PhD research.

Pilot Interviews

Three institutions were selected for the pilot interviews, based on the application of a set of simple criteria aimed at giving a small, but representative cross-sectional sample of Higher Education institutions within England and Wales. The criteria that were applied for selection were as follows:

- They should have undertaken capital building projects within the last 4 years.
- They should be core funded by the Higher Education Funding Council for England
- They should have a broad geographical distribution.
- They should represent each of the pre-1992 university, post-1992 university and non-university groups within the HE sector.

The participants selected for these pilot interviews were drawn from a group of Higher Education Institutions that were reflective of the broad distribution of Institutions across the UK. They were selected on a targeted basis by applying the foregoing criteria to give representation from each of the potential groupings of HEIs, to avoid potential duplication of type and to reflect broad geographical regions as follows:

- Interview 1: Midlands: Non-University HEI
- Interview 2: Southern England: Pre-1992 HEI
- Interview 3: Northern England: Post-1992 HEI

Interviews were undertaken with the Directors of Estates at these institutions with the purpose of assessing the degree to which the research was appropriately focused and relevant to the current context of Higher Education within England. The interviews were exploratory in nature and were semi structured to allow the participants to contribute freely to the discussion within certain parameters that were established by a series of broad questions. The questions that were posed to each of the participants were as follows:

Question 1: What do you understand by the term post-occupancy evaluation?
Question 2: What are your desired outputs and deliverables from the POE process?
Question 3: What are the specific aims of undertaking POE within your organisation?
Question 4: What POE models are you familiar with (if any) ?
Question 5: What POE models have you applied within your current organisation?
Question 6: How would you describe the usefulness and validity of the information liberated from the POE process?
Question 7: What specific factors are you seeking to measure with POE?

Analysis of responses by question

The interviews were recorded and transcribed verbatim to allow detailed analysis of the responses to each of the questions that were posed. The number of interviews that were undertaken was limited and there was no intention to attempt to draw generalised conclusions from consideration of their content. However, they were used as a mechanism for piloting the interview questions for the main empirical section of the work and to validate the proposed research topic as being suitable for the basis of PhD research. The following section summarises the responses to each of the questions posed within the semi-structured pilot interviews.

Question 1: What do you understand by the term post-occupancy evaluation?

There was a degree of consistency in the responses to this question, with all three respondents articulating that their understanding of the term post-occupancy evaluation

represented certain key themes. All of those questioned referred to the term 'audit' in defining the process of POE. There was a common view that the process of POE represented a systematic review or audit of the processes and procedures surrounding the delivery of capital projects and that this included an element of benchmarking or assessment against defined performance indicators. The comparison of actual performance relative to 'best practice' was cited by all three of the pilot interview participants.

However, there was less consistency in the views of those interviewed relative to the notion of user satisfaction, with only one of the interviewees considering the assessment of user satisfaction to be a key component of POE.

The author's interpretation of the interview commentary was that the assessment and benchmarking of the auditable elements of project delivery, such as time, cost and quality were perceived as being the factors that were subject to assessment through POE. The issues surrounding user satisfaction and real-time building performance management were recognised but were not prioritised highly by those interviewed during the pilot phase.

> *My understanding is that the term is used to refer to a post project audit of some sort – reviewing how the project went and whether it was delivered as intended*
>
> *The aim is to measure the effectiveness of what we do in delivering projects. We want to be able to demonstrate that we are operating best practice and that what we are producing is being evaluated in some structural fashion.*
>
> *There are really three strands to it – How do we perform as an institutional – How well was the project delivered? And how well does the completed project perform?*
>
> *My understanding of the term POE is the detailed analysis of completed construction projects. Normally I would expect to see data gathered about the experience of the building occupiers – whether or not they liked the building and whether they saw any major flaws or defects in its design.*

Question 2: What are your desired outputs and deliverables from the POE process?

The responses to this question indicated that there were three main themes associated with expectations of deliverables resulting from the POE process. Firstly there was the view that the process delivered the capacity to benchmark key performance indicators against sector or institutional norms. However, the examples that were put forward to illustrate this concept tended to relate to project delivery rather than the performance of the building in use. The singular exception to this related to energy management, which was cited in only one of the interviews as a factor against which benchmarks could be derived through a process of POE.

> *prescribed targets for energy use, running costs and so forth. So we would like to be able to benchmark these to show how well a project was performing against intention and target*

> *I would like to gain confidence that our approach to projects is robust. A reflection on some of our audit KPIs would be essential. We would want to know whether the project constituted value for money, and that it performed as a completed entity in line with the original brief. A before and after comparison with the design brief would allow us to assess whether the project was delivered well – as expected – or not.*

Secondly there was the issue of demonstration of the undertaking of due process and best practice in evaluating the outcome of completed capital projects. All of the interviewees presented comments to support the idea that a key outcome of the POE process was the demonstration that objective evaluation of the delivery of capital projects was being effected to allow the assessment of the performance of projects and project teams.

> *more about reviewing our own performance on individual projects and trying to make sure that the building performs as well as it can*

Thirdly the ability to refine and improve design briefs and project delivery through a process of learning and feed forward was cited as a key output from the POE process. This was presented by all of the interview participants as the primary outcome that was desired from the application of the POE process.

'..we would like to be able to benchmark these to show how well a project was performing against intention and target'

suppose it would be nice if we could show some sort of feed forward from a review to future projects.

They can be really helpful in assisting with the development of later briefs for similar projects

Question 3: What are the specific aims of undertaking POE within your organisation?

The interview participants provided differing responses to this question that suggested differing viewpoints of the purpose of the POE process. Whilst there was a degree of consistency regarding the understanding of the nature and purpose of the process, the justification and rationalisation of its use within the context of each institution was less clear. In two of the three responses conflicts were apparent between the generic understanding and justification of the process and the specific basis of application within particular institutions. In both cases the respondent indicated that although there was clear merit and value in undertaking the process there was little recognition of this at an institutional level. In these cases the process appeared to be applied to meet audit requirements for process review rather than as a mechanism for learning and feeding in to future projects; the completion of the audit process being the primary purpose of the POE.

You have to remember that a primary driver for these reviews is ticking an audit box so that good feedback can be gained from the funder or the auditors

there is still a way to go before these reviews give us what we want in a really consistent way ... we get lots of data but – so what? I bet if you asked most people what they had done with the detail data from a POE they would say – not much – or that is was simply archived

Notwithstanding these comments the individual Directors of Estates were positive about the benefits and aims of POE at a project and departmental level. Here they consistently cited the ability to learn for future projects as being the primary aim.

The issue of establishing and benchmarking key performance indicators (KPIs) was also a consistent theme in all three interviews. This element linked, in all cases, to the

evaluation of the project in terms of its delivery and the performance of the project team. Key factors that were identified relating to project performance were time, cost and quality. However, there was no specific definition of the term 'quality' other than by reference to the extent to which the final project achieved its original design specification or requirements.

The link between KPIs and performance in use was less strong, being cited in only one of the interviews. In this case there was a strong feeling on the part of the interviewee that benchmarking could only be applied to technical elements of building performance that were capable of measurement, such as energy consumption etc.

Question 4: What POE models are you familiar with (if any) ?

All three interviewees indicated that they were familiar with the concept of POE and the responses to initial interview questions supported this. There was a consistent ability to articulate the basis of POE through tailor-made models, although there was not a consistent use of the term POE. Two of the respondents demonstrated knowledge of defined models that are in common use both within the Higher Education environment and beyond. Both were aware of the AUDE/HEFCE model, although only one had direct experience of its use.

> *I know about the HEFCE model because it has been fairly well publicised in HE. I also know that others exist but I'm not sure about them in any detail*

The two interviewees that indicated a broad awareness of the AUDE/HEFCE model displayed a good understanding of its structure and content despite limited experience in its application.

Question 5: What POE models have you applied within your current organisation?

There was varying experience in the application of the POE process between the interview participants. All of those interviewed displayed a degree of knowledge of the various models of POE that are available and are utilised within the HE sector. However, there was limited experience of the various models that are in common

usage. All three of the interviewees indicated that they had experience of bespoke. Or tailor made approaches but only one had applied the standardised AUDE model or other accepted generalised models

> *We use our own internal review process here. The HEFCE/AUDE model is really detailed but we don't need anything like that level of detail. We have a simple internal review process that looks at project delivery and end results; it gives us what we need*

> *As well as the AUDE model I have used PROBE, ORBIT and DQI. They all have their ups and downs. Some are simply far too sophisticated – they actually give you too much information sometimes*

> *At the University we are required to undertake POE using a variant of the AUDE/HEFCE model. The full model is way too complex so we adopt a sort of variable approach*

There was a consistent theme relating to the perceived complexity and scale of these models, with all of the commentators citing this as a negative feature. Whilst acknowledging the extent to which these models gathered data to allow detailed analysis, the interviewees considered that they actually went far beyond what was necessary. The perception was not that they were ineffective or inappropriate as tools for the evaluation of project and building performance, but rather that they were misaligned to the requirements of the individual institutions. Simplicity was noted by all participants as a key requirement for POE within their own individual settings.

Question 6: How would you describe the usefulness and validity of the information liberated from the POE process?

The responses to this question were linked to the particular POE models with which people were familiar and to the key drivers for the process within each of the institutions. All three of those interviewed expressed reservations regarding the usefulness or impact of the outcomes of POE. Their comments in this regard were not directed at the lack of validity of the process in itself but rather the alignment of the process to their own specific needs. The earlier comments regarding perceptions of excessive complexity of the models was reiterated in responding to this question along with comments from two of the interviewees to suggest that they were too costly.

The AUDE model I'm not sure – we don't use it as it is first too big and complex – not to mention costly

My thoughts on that are that it is a bit too complex and costly and at the same time a bit generic. Projects vary so much that we need to use tailored variants to get from it what we need. We are measuring different things in different vases so we can't really be generic about the models and the factors that may or may not be important.

One of the participants expressed the view that the data was limited in its usefulness as a result of the lack of technical knowledge and understanding on the part of those questioned within the POE process.

We would like to know that the end users are happy – but they generally don't have sufficient technical knowledge to make informed judgements

There was consistent recognition that the process of POE was potentially valuable and that the adoption of an appropriate model could add value. This was particularly recognised in the context of feeding lessons learnt in to future projects rather than addressing real time performance issue within the building. The concerns expressed in response to the earlier question (3) in relation to the effectiveness of the process at institution level were repeated. There was a feeling amongst all of the respondents that the outcomes of the POE process could be very insightful and valuable, but that there was a tendency for them to be treated as archive or audit information, rather than performance enhancement tools.

There was also a strong, consistent view that the process and its outcomes could be enhanced by making application more simple and more directly relevant to specific institutional and project contexts.

Question 7: What specific factors are you seeking to measure with POE?

There was a divergence of view amongst the interviewees regarding the focus of the POE process. All of the respondents noted that the evaluation and benchmarking of the factors associated with the delivery of a building project were important parts of the process. However, the assessment of user satisfaction and the factors that influence it

were less well recognised as features of the process. Several reasons were presented for the differing levels of prioritisation of these factors, including the nature of audit or reporting protocols that were seen as drivers of the process. The factors that were identified as significant within the process were readily divided in to two categories; factors relating to project delivery, such as time, cost and quality; and factors relating to performance of the end product, such as measures occupier satisfaction and comfort. The latter of these was subject to some degree of scepticism in relation to its potential for objective evaluation and relevance to overall 'success' in the delivery of building projects.

There were several references to user 'satisfaction' and 'comfort' along with commentary on environmental factors affecting these themes. However, the degree to which such references were particularised or made specific was highly limited and there was no definitive identification of the specific factors that were deemed to be critical in terms of user satisfaction.

> *There is the old diagram of time – cost – quality and POE is about all of these things. We want to assess the quality of the end product – the building – and see if it provides student satisfaction and user satisfaction if not – why not? We also want to assess how the costs turned out relative to Capex – this is really key for us*
>
> *We are interested in assessing the comfort of the occupiers – is it too warm, too cold – whatever*
>
> *We set fairly prescribed targets for energy use, running costs and so forth. So we would like to be able to benchmark these to show how well a project was performing against intention and target.*
>
> *They are a very personal set of perceptions. It's far easier and probably more productive to focus on things that we can actually benchmark and that affect the overall technical operation of the faculty*
>
> *The user satisfaction thing is important – but really the process, contract, cost issues are make or break*

The three Directors of Estates that were interviewed all recognised the importance of environmental factors upon overall user satisfaction with buildings. They all, also, acknowledged the influence of these factors upon work and study effectiveness. However, none of the respondents were able to particularise the specific factors that

they were seeking to measure through POE. The interviews incorporated broad references to user comfort and satisfaction, together with identification of factors such as heat, light and sound. Although these areas were referred to within the interviews the commentary reflected over-arching themes and principles rather than specific, measurable performance factors.

> *Naturally we want the users to be satisfied with the environment but there will always be people who are not happy and often it is difficult to resolve the issues that affect them. They are a very personal set of perceptions.*

> *We are interested in assessing the comfort of the occupiers – is it too warm, too cold – whatever.*

> *What we want from them is different almost every time*

Thematic Overview

The transcripts were reviewed and analysed to identify themes and trends relating to user satisfaction using NVIVO version 10. The process was, in part, concept driven by the themes that were identified within the literature review. It was also, partly, an open coding approach as codes were evolved and developed from the original concept driven coding. Table 4.4 summarises the outcomes of the coding exercise.

The nature of the interviews was such that discussions took place relating to the participants' experience/ perception of POE, their views on its purpose and the factors that they considered to be influential on user satisfaction. The interview transcripts liberated little detailed data relating to specific factors, although broad themes were identified.

Theme	**Interview**			
	A	**B**	**C**	**Total**
Building	3	7	6	**16**
Internal Environment	1	2	2	**5**
Performance	1	4	3	**8**

Table 4.4: Coding Themes from pilot interviews

The comments fell in to two clear categories that relate to the physical environment of the building with all interviewees commenting on both internal environment and building performance.

All of the interview participants commented upon the function of POE in relation to the assessment of internal environment and its effect upon user satisfaction. There were five comments relating to this aspect, although the issues that were raised were quite generic. There was a general view amongst all interviewees that internal environment and comfort factors were influential upon users' perceptions of satisfaction with buildings. However, there was little in the way of identification or description of specific factors or elements of internal environment. In two of the three interviews reference was made to the impact of heat and light as factors affecting user satisfaction. Building performance was also a consistent feature within the interviews although, once again, the level of detailed description of this was limited.

4.4 Summary

The pilot interviews were aimed at assessing the broad perceptions of the purpose, usefulness and efficacy of POE within HEIs. They were conducted with the intention of gauging the extent to which Estates Directors or equivalents perceived the process of POE to be valuable and to gain insight in to the manner in which the outcomes of the process are used. Analysis of the interviews suggested that the way which POE is applied, the models adopted and the focus of their data collection and analysis is variable within the HE sectors. They also allowed the author to infer that the degree of satisfaction with the outcomes of the process was mixed due to a combination of factors including cost of undertaking POE and lack of definitive conclusions arising from it. Although the number of these interviews was small and as such it is impossible to generalise from them, they also suggested, strongly that the data gathered using the established models cited did not necessarily align with the data sought by those applying the process. Perhaps for this reason there was a tendency to favour custom-made solutions when applying the process of POE with standardised models or toolkits being seen as overly complex or unsuitable for the needs of many institutions.

Reservations were also clear with regard to the nature and usability of the data that is generated, with the quantitative data that is potentially liberated being subject to a degree of criticism. This was focused on the issue of complexity of data and linkage to the overall purpose of the POE process. There was a degree to which qualitative data tools appeared to be favoured in some quarters due to the ability to gain deeper insight with clearer focus upon the specific context of individual projects.

The purpose of the process of POE was subject to some variation in interpretation and application with some commentators considering the evaluation of building performance in use to be the primary function. Others referred to the development of design improvement through feed forward loops, whilst there was also a view that the process was aimed at evaluating the performance of the design and project delivery processes. Each of these clearly drives the process of POE in different directions and the models that exist tend to focus on one of these only. The AUDE model attempts to capture all three elements within its toolkit but is seen by some as cumbersome and complex, resulting in very low levels of application within the initial sample group.

Key findings from the pilot phase were as follows:

- POE is recognised within the HE sector as valid tool for facilities performance assessment with a range of standardised and hybrid models in use across the sector.
- The use of bespoke (custom-made) models or hybridised versions of existing models is favoured over standardised models, which are seen as potentially mis-aligned to the needs of individual users in individual contexts.
- Several of the standardised models or frameworks, including the AUDE model are perceived as overly complex and costly in application. This, allied to scepticism regarding the consistency of the data liberated inhibits their widespread adoption within the sector.
- POE is identified as a tool for informing future design briefs and projects, although the ability to liberate full benefit from this process is limited due to the uniqueness of each individual project. This is seen as a major inhibitor to the adoption of POE generally and is seen as a strong driver for the use of custom-made models over standardised models.

- Although the potential for POE to act as a tool for real-time building performance enhancement is recognised it is not seen as the primary purpose of the process.
- The evaluation of user satisfaction as part of the building performance assessment process is identified but not considered to be of primary importance within the POE process.
- The impact of internal environmental factors and comfort factors is noted as being influential upon overall user satisfaction, although the extent to which these are identified in specific terms is limited. Thermal comfort, lighting and acoustics are identified as broadly influential.
- There is a perception that the evaluation of facilities performance is not considered to be an issue of significance at institutional level and there are clear reservations regarding the real impact and usefulness of the process.
- There is an understanding that POE is a useful audit tool for assessing project delivery against best practice as well as for evaluating facilities performance in use against established KPIs.

The results of the literature review, landscaping questionnaire and pilot interviews, taken together were considered to support the view that the proposed research scope was valid. As such the research scope and questions, although refined slightly, were progressed to the second phase of the project.

5.0 Analysis and Evaluation of the Application of POE in Higher Education Institutions

5.1 Introduction

The second stage of the project was the principal phase of data collection, analysis and interpretation. The primary objective of this phase was to confirm and test the hypotheses defined at the outset of the project. The literature review and the pilot phase of the project liberated a range of findings that validated the original aim and hypothesis as valid bases for PhD study. The outcomes of the literature review and the pilot phase were used to refine the hypotheses to be examined during the main phase of the research. The resulting hypotheses were as follows:

Primary Hypothesis:

That:

Existing models of POE have developed to become overly complex and costly in application. As a consequence the use of POE as a facilities performance enhancement tool is inhibited. Effective utilisations of POE as a performance enhancement tool within the HE sector requires the development of a pragmatic model derived from specific user requirements in the given context.

Sub-hypotheses:

That:

The application of POE is inconsistent across the Higher Education sector in England and Wales and is compromised by differing drivers on the part of those applying them

Assessment of building user satisfaction in HE environments using existing POE models tends to liberate inconclusive results

The perceptions of key factors influencing user satisfaction differ between building users and building operators

In order to test these propositions a series of research questions were established as follows:

- To what extent is POE used within HEIs in England and Wales?
- What do those applying POE consider its purpose to be?
- What data are collected and how are they used?
- Do the outcomes of the POE process match the expectations of those applying them?
- To what extent does POE identify and measure performance factors that influence user satisfaction?
- To what extent does such data align with users' perceptions of factors that affect satisfaction?
- How is the qualitative and quantitative data analysed and used?
- How effective could we consider the current models to be?

In order to address these research questions a range of qualitative and quantitative tools was utilised to gather and analyse data from building users and from those utilising the process of POE. As a result the second stage of the research involved engagement with both end users and with Directors of Estates and appropriate sampling approaches were employed for each of the participant groups. A grounded theory approach was considered for the qualitative elements of this phase of the work as it can utilise various tools for data collection; two of the most common being in-depth interviews and focus groups. Both of these were used during the second phase of the research, with different objectives.

In-depth, semi-structured interviews were used to gather data relating to the experiences of Directors of Estates in using POE, their views on its purpose and usefulness along with their perceptions of the factors likely to affect user satisfaction.

Focus groups were used to gather data from building users regarding their views on satisfaction associated with the building in which they work and study; specifically aiming to identify the factors that impact positively or negatively on their satisfaction.

In addition, there was the application of a quantitative component in the form of the AUDE questionnaire, which was distributed to building users. This was used in order to gain data regarding their perceptions, in the form of scores, of a range of factors that relate to user satisfaction. The questionnaire also allowed the provision of qualitative comments and these were collated and analysed as part of the qualitative analysis process.

5.2 Research Design

The main data collection and evaluation phase of the project comprised a number of discrete qualitative and quantitative components. Each of the individual components was aimed at addressing specific research questions as set out above. The outcomes of the individual components are expressed in terms of measurement, in the case of quantitative components and understanding in the case of the qualitative components.. The components of this phase of the work are summarised in table 5.1 below.

		MEASUREMENT	UNDERSTANDING
QUANTITATIVE	**AUDE POE**	• User satisfaction data regarding defined elements within the questionnaire considered to impact on overall satisfaction • User perception of overall satisfaction with building.	
QUALITATIVE	**AUDE POE free text comments**		• Wider views of users within defined sub-categories as defined within the questionnaire.
	Semi-structured interviews with DoEs		• Establishing DoE's perceptions of purpose and effectiveness of POE as a tool for assessing user satisfaction. • Perceptions of factors important to HEIs and what they are seeking to measure through POE. • DoEs perceptions of factors impacting on user satisfaction.
	Focus Groups with Users		• Identification of factors important to users in achieving satisfaction in buildings. • Relative importance of factors affecting satisfaction.

Table 5.1: The components of the primary phase of the research

For each of the components appropriate sampling approaches were applied to identify representative samples from the wider population sets of building users and users of the POE process.

Building Users (Staff and Students)

Participants from this population stream were required to engage with several research components within the second phase of the project. In the first instance they were required to respond to a questionnaire based on the quantitative part of AUDE POE model that is intended for measurement of user satisfaction. Secondly there was a need for participants to contribute to focus group sessions aimed at exploring their views in more detail to gain deeper insight in to the perceptions of building users regarding factors that influence overall satisfaction

AUDE Toolkit questionnaire

Quantitative research was applied to the project, in the form of the established AUDE POE questionnaire, to address the specific research aims that were defined at the outset. The questionnaire, which forms part of the AUDE POE toolkit, was applied to attempt to gauge users' perceptions of a range of defined factors in relation to the two selected buildings. A key element of the research was the evaluation of the outcomes of existing models of POE used within HEIs and consideration of their validity. The model that is in most common usage is the AUDE model, which provides HEIs with a framework and toolkit for undertaking POE. This includes provision for the use of quantitative data gathered from questionnaires. There are also elements of qualitative analysis within the model such as optional free text responses associated with the questionnaires together with the potential for interviews and focus group sessions. In order to test the primary hypothesis it was necessary to analyse users' responses to a typical questionnaire based, quantitative, POE model. Given the research setting and its generally accepted focus towards HEIs the questionnaire template from the AUDE toolkit as the basis for gathering quantitative data regarding user satisfaction and building performance.

This was the only quantitative component of the main phase of the research and was intended to address the following research aims:

> *To assess the degree to which existing models of POE are effective in evaluating users' perceptions of overall satisfaction with buildings.*

The research questions that were addressed in this part of the work were as follows:

> *Does the use of the questionnaire accurately measure factors associated with satisfaction?*
> *What are the key factors identified within the questionnaire that impact upon satisfaction?*
> *How meaningful is the data in terms of facilitating enhancement of building users' satisfaction?*

As a result of the differing research tools applied a 2 stage process of sampling was effected as follows:

The AUDE questionnaire was distributed to staff and student groups who were known to be regular or occasional users of the buildings that formed the research setting. By using selected email distribution lists participants were targeted based on two simple criteria; firstly that they formed part of a recognised user group of either staff or students and secondly that they had sufficient contact with the selected building environment to allow the expression of their views to be valid and meaningful within the research. To some extent there is an element of simple random sampling within this process since the questionnaire was distributed to a wide range of potential respondents with a random potential for response. However, the initial selection of the groups targeted for distribution of the questionnaire was based on the aforementioned criteria, hence, there is a degree of purposive sampling.

User Focus Groups

The participants for the focus group elements of the research were selected to ensure that representative input was achieved for each of the building user groups. Each of the focus groups comprised between 7 and 9 participants drawn from the defined groupings of student and staff users of the buildings. There was an element of convenience sampling involved in this process as the final participants were selected from a wider group of those that had volunteered to contribute to the focus groups.

Focus groups were used in the second phase of the research with the intention of liberating qualitative data relating to users perceptions of satisfaction in the context of building occupancy. The use of focus groups has been identified as having numerous advantages in that they allow data to be generated through open or structured discussion with stakeholders rather than relying on direct response to interview questions that may be considered as potentially directing the responses of participants.

There are several potential disadvantages associated with this approach and there have been suggestions that the use of focus groups has the potential for abuse and bias within social and political research through the following mechanisms:

- Selection of participants
- Direction of focus group discussion
- Bias in interpreting responses

(David & Sutton 2011)

These areas for potential bias were recognised by the author and the approach to undertaking the focus groups sessions was designed to avoid, as far as possible, the potential for undermining the validity of this element within the overall research design. The potential for bias and abuse of the process was minimised through the use of an objective facilitator to manage the operation of the focus groups. It is recognised in many areas of social science research that effective focus group require the contribution of trained interviewers who are knowledgeable about group dynamics. Researchers who are close to the subject matter may knowingly or unknowingly introduce bias in to the discussion and the end results by providing cues about what

types of responses are expected or desirable. (Krueger 1988, Stewart & Shamdasani 1990). Hence, this element of best practice was incorporated in to the undertaking of the focus groups to ensure that the potential for bias was minimised and the issues associated with group dynamics were fully recognised. The author collaborated with an academic colleague, who was experienced in the use of focus groups within qualitative research, to facilitate the focus group sessions objectively. The use of an independent facilitator was aimed at ensuring that the operation and outcomes of the focus groups were as objective as possible and were unbiased by the author's potentially pre-defined views. The use of a facilitator was deemed to be beneficial also in ensuring that the operation of the focus groups was not compromised by:

- Domination of discussion by one or more individuals
- Non-participation of focus group members
- Extensive discussion unrelated to the defied research questions

Accordingly, Dr. Martyn Stewart agreed to facilitate four focus groups on behalf of the author. These were as follows:

Tom Reilly Building:	Student Group 1
	Staff Group 1
Art & Design Academy Building:	Student Group 2
	Staff Group 2

In order to prepare effectively for the focus groups the author met with Dr. Stewart and provided a detailed briefing note setting out the nature and detail of the overall research and the context of the focus group element within it. The main research questions to be addressed within the focus groups were set out as follows:

Do you have discernible feelings of satisfaction or dissatisfaction associated with the building in which you work or study?
If so, what are the factors that affect your feelings about the building?
What features or characteristics of the building and your interaction with it affect your overall satisfaction?

Are there factors that are not linked to the physical building environment that impact upon your overall satisfaction with the building?

The author identified groups of student and staff building users, selected at random from the population of the two buildings forming the study, that were willing to participate in the focus groups. The details of these groups were passed to the facilitator, who then liaised with individuals to formulate the focus groups. This process aimed to ensure that each group represented as far as possible a random, representative, sample of building users thus eliminating any potential for bias associated with any specific sub-group of users.

A set of general principles that are accepted as being desirable . (Krueger, R. A. (1994)) was applied for composition of the groups as follows:

- Selection of participants was undertaken so as to achieve minimisation of potential for bias through, as far as possible, randomization of selection.

- Group size was controlled with between 7 and 9 people participating in each focus group. This size of group was considered small enough to give everyone the opportunity to express an opinion, whilst being large enough to provide diversity of opinions.

- Groups were composed of people who were drawn from similar areas of the population set but whom were not too familiar with one another.

Users of the POE process (Directors of Estates)

Participants from this population stream were included in all phases of the project. In the second phase they engaged in a range of semi-structured interviews in phases aimed at gaining insight in to a range of issues surrounding the form, function and efficacy of the POE process. In order to facilitate this element of participation sampling was undertaken based on the following selection stages:

Semi-structured Interviews

Semi-structured interviews were undertaken with the Directors of Estates that were selected using the quadrant analysis described earlier. The structure and content of the interviews was based on the questions that had been included in the pilot interviews undertaken in the first phase of the work.

The consideration of the perceived value and validity of POE within HEIs was an intended area of focus for the interviews in stage 2 of the work. The identification and evaluation of the factors perceived by the Directors of Estates to impact upon user satisfaction were also key elements of this component. In addition they focused on the specific application of quantitative POE models in Higher Education Institutions and the real-life experiences of Directors of Estates, or equivalents who had experience in using them. Interviews were selected as the basis of the qualitative work because they allowed the gathering of open opinion and viewpoint rather than constraining responses as might be the case with a questionnaire based approach.

The initial sample that had been identified within stage 1 of the project was retained as the base population set, derived from the filtered list of Directors of Estates within the AUDE catchment. This sample had been subject to the distribution of the initial landscaping questionnaire and 31 out of 114 members of the sample had responded with varying responses to the 4 questions that were posed. The data gathered from this exercise was used to facilitate a second phase of sampling.

Within the second stage of sampling the initial population set, defined from the first stage of sampling, was broken down into representative clusters to form the basis of representative groups for participation in the phase 2 interview process.

The clusters within this sampling stage were drawn from the questionnaire that was distributed to DoEs as part of the first phase of the research. Following the exclusion of HEIs that were unable to undertake POE due to the fact that they had not undertaken capital projects within the recent past four discrete clusters were identified for participation in the study. These are summarized below:

	Capital Projects Eligible for POE	POE Undertaken?	POE delivered Expected Outcome?	Number of Respondents
Cluster A	Yes	No		4
Cluster B	Yes	Yes	No	2
Cluster C	Yes	Yes	Partly	13
Cluster D	Yes	Yes	Yes	12

Table 5.2: Project participants, cluster analysis

Cluster B drew the lowest number of respondents, with two institutions indicating that they had used POE without success. As such this was used to set the basis for the final interview sample to ensure appropriate balance and two institutions were selected from each of the other clusters. Hence, a total of eight interviews were conducted with equal representation from each of the four clusters.

The data from the interviews and focus groups was then compared with the quantitative data generated from the application of the AUDE questionnaire in an to attempt to triangulate the data.

5.3 Analysis and Discussion of data

The majority of pre-existing models of POE rely heavily on the use of questionnaires to harvest data from buildings users. This is true, to an extent, of the AUDE model that is heavily used in Higher Education. The AUDE model allows quantitative data from questionnaires to be supplemented to a degree by the facility for respondents to add further comments in restricted commentary boxes should they so wish. The model also features much broader elements of qualitative analysis as part of a wider application to capital project analysis, although these are not included within this part of the work.

The AUDE questionnaire was not devised or designed by the author. The model was developed to attempt to liberate design and satisfaction data that could be used to either improve future designs or to fine-tune completed designs. The existing AUDE model forms part of the research design insofar as it provides a benchmark basis of comparison between existing primarily quantitative models and potential, less structured qualitative approaches. The application of this quantitative element is both longitudinal and cross-sectional or parallel. The AUDE model was applied to two

different buildings within Liverpool John Moores University estate: The Tom Reilly Building and the Art and Design Academy Building. The model was also applied twice to each building over a period of 18 months. Hence the application of the quantitative elements of the work was structured as shown in Figure 5.1.

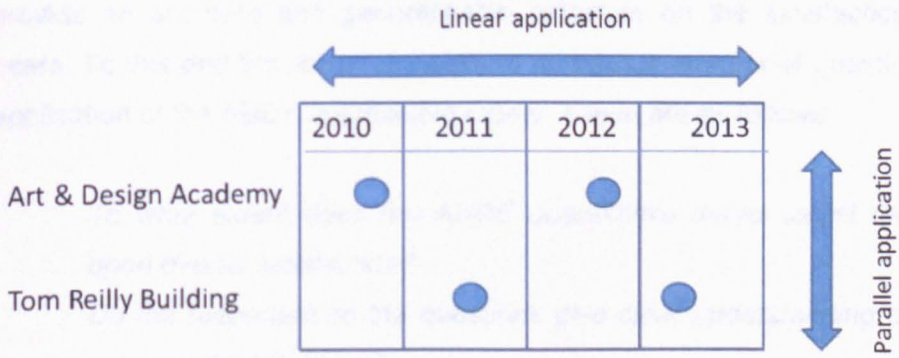

Figure 5.1: linear & parallel approaches

The model utilises a simple Likert scale to elicit responses to a range of closed questions. These are set out in appendices to this thesis. In addition the survey allows the facility for respondents to provide short commentary on each of a number of the questions in the questionnaire. The survey gathers limited commentary in each of the sub-sections of the survey with a free-text commentary facility.

The qualitative responses provided are limited and they follow more direct, closed questions relating to specific characteristics or variables that the surveys seek to measure. As such they provide expansion or qualification of the quantitative responses, rather than undirected, open qualitative commentary.

The qualitative responses that were gathered were analysed using the qualitative approaches discussed in a separate section of this document.

The approach to quantitative data gathered using the AUDE model was pre-determined prior to adoption by the author. The standard AUDE questionnaire was utilised as the method for gathering quantitative response from building users. The model seeks to measure defined factors or characteristics of buildings and their functions that have

been considered by the creators of the survey model as significant in terms of user satisfaction. As such the author has not had input into the selection of the individual characteristics or variables. The purpose of the research is not to seek to generate appropriate quantitative questions for the use within such surveys, but rather to assess whether the questions posed and the responses gathered when using such surveys provide an accurate and generalisable reflection on the satisfaction of the building users. To this end the research seeks to address a number of questions regarding the application of the AUDE quantitative model: These are as follows:

> *To what extent does the AUDE quantitative model target factors that impact upon overall satisfaction?*
> *Do the responses to the questions give clear understanding of the factors that are important to users?*
> *Are there consistent linkages between key factors of building performance and overall satisfaction of users?*

The research aims to assess whether the factors that are considered important by the designers and operators correspond to the factors that are perceived as important on the part of building users.

The AUDE model, in allowing the response to a generic question relating to overall satisfaction provides the opportunity to consider the linkages and correlation between responses to this question and other individual questions or groups of questions within the survey in a simple manner. In this sense the overall satisfaction is the dependant variable with the potential for one or more independent variables to exist within the question set of the model questionnaire. There may also, of course, be one or more control variables that could influence the effect of and relationship between the independent and dependent variables.

The use of the Likert scale within the survey allows the consideration of the various responses as ordinal variables that can be considered and analysed using quantitative approaches following the conversion to numeric description. As previously noted the AUDE survey gathers responses using a likert scale with scale items ranging in phraseology depending on the context and type of question. These scale items

correspond to a rating score illustrating extremes of satisfaction/dissatisfaction, significance/non-significance, impact/non-impact and so forth.

The AUDE questionnaire includes 71 Questions although several of these are repeated using a sub-grouping approach based on answers from respondents. The model was applied in 4 discrete instances over a period of 3 years and in the context of 2 separate buildings. The data is presented in the following sections based on the sequence of the questionnaire and the date and building location.

Section 1: Questions 1 - 4
Relating to information about the respondent, their role and their pattern of working

Section 2: Questions 5 – 7
Relating to information about the respondents' location within the building and their perceptions of quality of the locations.

Section 3: Question 8
Relating to respondents overall satisfaction with the building

Section 4: Questions 9 – 14
Relating to respondents satisfaction with specific elements relating to the building in general

Section 5: Questions 15 – 24
Relating to respondents satisfaction with specific elements relating to communal areas of the building

Question 24 is a free text question that provides the opportunity for respondents to give commentary on the issues contained within questions 15 – 23

Section 6: Questions 25 – 47
Relating to respondents satisfaction with specific elements relating to their primary work area within the building

Question 47 is a free text question that provides the opportunity for respondents to give commentary on the issues contained within questions 25 – 46

Section 7: Questions 48 – 70

Relating to respondents satisfaction with specific elements relating to their secondary work area within the building

Question 70 is a free text question that provides the opportunity for respondents to give commentary on the issues contained within questions 48 – 69

Section 8: Question 71

Question 71 is a free text question that provides the opportunity for respondents to give commentary on the issues that may not be defined within the questionnaire

Section 7 is an exact repetition of the questions within section 6 of the survey form, simply detailing a different area of the building. The survey form also allows respondents to add tertiary and subsequent work areas by simply replicating the questions from section 7 as necessary.

5.3.1 Quantitative components of the Research

In order to translate the responses into quantitative data for analysis they were summarised as numerical equivalents and compiled into complete data sets.

The resulting data were analysed using a range of inferential statistical tests through SPSS. Examples of the outputs from the quantitative data analysis are contained within appendix 8 and the following sections describe the results and their interpretation.

Inferential statistical tests are considered to fall within one of two general types:

Parametric tests: these are applied where the response data conforms to a normal distribution curve and is used to analyse interval data or ordinal data when it can be argued that the data is of a form that can be analysed as if it were interval data. Within

the research the use of the likert scale allows the transformation of ordinal data in to a form that can be analysed in this way.

Non-parametric tests: these are used where there is a non-normal distribution of data or where there is a small sample size.

The data from all of the instances of application of the questionnaire were tested using SPSS to assess normality in order to establish the most appropriate tests that should be applied. Each of the data sets from the applications of the survey questionnaire were tested within SPSS using both the Kolmogorov-Smirnov and the Shapirro-Wilk test for normality. In all instances of the survey, the tests were significant at the $p<0.05$ level, indicating that the data were not normally distributed. As a result it was deemed inappropriate to apply parametric statistical tests and a range of non-parametric tests was applied to the detailed analysis.

Tests for independence between respondent groups

The respondents could readily be classified in to groups by occupancy type and it was considered appropriate to undertake analysis of the responses to the survey questions relative to each of the groups. In order to test whether the degree to which the responses to individual questions varied according to respondent group SPSS was used to carry out non-parametric tests. Two options were considered in these regard, the Chi-squared test for independence and the Kruskall-Wallis test.

Chi-square is a non-parametric statistical test (sometimes called distribution free statistics) that is used when parametric tests are not suitable. Parametric tests assume that the data set has certain characteristics, i.e. the means will be similar for each set of data and/or the data follows a normal distribution pattern. When these conditions are not met with the data set, non-parametric tests need to be used. The use of nonparametric tests allows the analysis of data that comes as frequencies (Salkind, 2004) The chi-square test allows data to be tested to see if there is any statistically significant difference between two discrete groups of respondents classified under different variables.

However, the research included responses for five different groups, necessitating a different approach that could deal with such a comparison.

Had the data been normally distributed the application of one way analysis of variance (ANOVA) would have been adopted. However, due to the non-normal distribution of data this was not appropriate. The intention to explore the impact of user type, defined by the 'occupancy' label within the questionnaire, upon the responses to the questions contained within the survey relating to satisfaction with the building was still deemed necessary and an appropriate non-parametric test was applied in the form of the Kruskal-Wallis test.

This test indicated that at the $p<.05$ level there was significant difference between the respondent groups in the case of the following questions:

ADA 2010:	*10a, 14, 15,18, 20, 28, 32, 33,*
ADA 2012	*9, 14, 17, 40,*
TRB 2010	*9, 10b, 10c, 10d, 12, 14, 19, 21, 22, 25, 31, 34, 35, 40, 41, 42, 46*
TRB 2013	*14, 15,*

The only questions that liberated significantly different responses between occupancy groups in more than one instance of the survey were as follows:

Question 14:
'How clean is the building? *4 instances (ADA2010, ADA2012, TRB2010, TRB2013)*

Question 15:
'Is the air fresh or stale?' *2 instances (ADA2010, TRB2013)*

Question 40:
'Is there too much or too little natural light?' *2 instances (ADA2012, TRB2010)*

These results suggest that the only factor relating to satisfaction that is seen, consistently, differently between the occupancy groups is that related to cleanliness and cleaning of the building. However, the tests conducted using the Spearman rho coefficient of correlation show no significant correlation between this factor and overall satisfaction with the building.

Reliability

The test that was applied to assess the internal reliability of the data was the Chronbach's alpha. This test is intended to determine whether all of the questions within a specified range actually test the same construct. A construct, in the context of survey based research, being the underlying theme or subject matter that the survey questions are intended to measure; in this case user satisfaction. User satisfaction is a complex construct that is based on observation of numerous variables rather than a single, observable referent. This accords with Cronbach and Meehl's (1955) definition of a hypothetical construct as;

'*a concept for which there is not a single observable referent, which cannot be directly observed, and for which there exist multiple referents, but none all-inclusive.*'

As such there is no observable single variable that could be considered satisfaction, but rather there is a range of factors and indicators that combine to create the perception of satisfaction. It is these that the questionnaire seeks to measure. There is also a reference benchmark in the response to question 8 regarding overall satisfaction that seeks to gain respondents own perception of the total construct of 'satisfaction'.

Within the AUDE model the nature of the questions varied, along with the scoring basis and range. There are several different approaches to the use of the Likert scale contained within the survey. Hence, the questions were split in to sub-sets for the purpose of testing using Chronbach's alpha. The two main groupings of questions directed at establishing views of satisfaction fell within the question classifications that the author has labelled as:

Satisfaction: with responses based around a 1 to 7 scale with 1 being the least positive response and 7 being most positive.

Bi-polar (2-way) satisfaction: with responses based around a 1 to 7 scale with 4 being neutral and 1 or 7 being opposing, equally negative responses. E.g. too hot and too cold

Questions within these classifications were clustered and tested within SPSS using Chronbach's alpha for each instance of the survey. For the establishment of reliability within the scale there are several key indicators that must be considered when interpreting the outcome of the test:

The Chronbach's alpha value should be above 0.7, and ideally above 0.8

- There should be no negative values are within the inter-item correlation matrix. The presence of negative values within this matrix is an indicator that questions are incorrectly, reverse scored.

- The inter-item correlation value should be high, indicating a strong relationship between the items.

- The results for internal consistency for the questions using bi-polar scales showed poor internal consistency, with Chronbach alpha coefficients below 0.7 in all applications of the test.

The results for questions using linear satisfaction scale were varied with scores above 0.7 in three of the four instances of the survey.

In all instances there were negative values in the inter-item correlation matrix, indicating issues with incorrect reverse scoring of some questions. In all instances the inter-item correlation values showed low to very low relationship between the items within the scales.

Had the questionnaire been generated by the author, interventions would have been effected to reverse scoring on some questions. However, the purpose of the research was to test the efficacy of the AUDE survey method, which has been developed by others and is applied widely across the HE sector. As such it would be inappropriate to alter the nature or content of the survey forms.

The summarised results from the Chronbach's alpha test are set out in table 1 of accompanying Appendix 6.

Analysis of the Questionnaire

The approach to analysing the data derived from the questionnaire surveys varied between the sections of the questionnaire as a result of the differing nature of the questions and their potential responses. The following statistical methods were used to analyse the data:

- Responses were analysed and presented using comparative, descriptive statistics.

- Descriptive measures of central tendency (mean, median and mode) were used together with standard deviations to interpret the responses to individual questions and to selected groups of questions.

- The data were tested for normality prior to the undertaking of a range of inferential statistical tests.

- Elements of the survey data were subjected to correlation analysis aimed at identifying linkages between individual questions or sets of questions and question 8, which relates to overall satisfaction with the building. However, the non-normal distribution of the data forced an alternative approach to this aspect rather than using normal correlation analyses.

Prior to commencing the detailed analysis of the data the response rates and consistency of form of the data were reviewed. This review process identified

differences in the response levels between the various sections of the survey. The responses for section 7, relating to respondents' secondary workplace and section 8, relating to other sub-areas were greatly reduced relative to the number of responses in total. The responses are summarised below for each of the AUDE survey applications.

BUILDING	DATE	Section							
		1	2	3	4	5	6	7	8
TRB	2010	95	95	95	95	95	95	50	20
	2013	43	43	43	43	43	43	32	18
ADA	2010	57	57	57	57	57	57	30	21
	2012	40	40	40	40	40	40	20	16

Table 5.3: Response levels to AUDE surveys

This pattern of response for each of the surveys undertaken resulted in a large number of missing values in sections 7 and 8 of the surveys. In all cases the pattern of response was essentially similar, with consistent fall off in responses in the later sections of the surveys. This was compounded as a result of the ability for respondents to specify further, additional areas within section 8 of the survey, resulting in inconsistent application of the questions to specific areas.

However, the responses to the earlier sections, which relate to the building as a whole, communal areas and the respondents' primary work area were completed consistently. The lack of responses to sections 7 and 8 of the questionnaire appeared, mainly, to be a consequence of respondents not identifying secondary or tertiary work areas, rather than simply failing to complete the questionnaire. This necessitated re-consideration of the data-set to allow valid analysis. In doing this two alternatives were considered:

Application of missing values analysis using SPSS to allow analysis of a 'full' data-set.

Or

Removal from the data sample of the later sections of the survey relating to secondary and tertiary work areas and analysis of only entire building and primary workplace data.

An initial attempt was made to apply the missing values analysis within SPSS, which adopts an algorithm that predicts average values for missing data, based upon the distribution of existing data. However, this approach skewed the data heavily due to the large number of missing values within the sections of the questionnaire relating to secondary and tertiary work areas. Hence, the decision was taken to exclude the data relating to secondary and tertiary areas and to analyse the data for all instances of the survey relating to the building as a whole and to the respondents' primary work area.

The remaining data was analysed within a series of sub-sections to allow the respondent groups within each building to be considered separately for responses to questions within the following sub sections:

Section 3:	Satisfaction with the building
Section 4:	The building in general
Section 5:	Communal areas
Section 6:	Primary work area

Several questions are duplicated within two or more of the sub-sections, allowing the same question to be asked in relation to the building in general, communal areas and primary work area. Where this was the case, the questions were also analysed in clusters against each other and against question 8 (overall satisfaction) to test the degree to which themes within the questionnaire affected user satisfaction.

The themes that were used to cluster questions were aligned to the broad areas identified as key themes within the literature review, as follows:

Safety/security	*Qs 9, 10a, 10b,10c, 10d, 10e,*
Light/lighting	*Qs 10d, 21, 22, 23, 39, 40, 41, 42, 43, 44, 45*
Accessibility/movement	*Qs 11, 12, 13, 10e*
Air quality	*Qs 15, 16, 17, 27, 28, 29, 30, 31,*
Heat/Ventilation	*Qs 18, 19, 32, 33, 34, 35*
Noise	*Qs 20, 36, 37, 38*

Within the analysis that was effected using SPSS these were used to define sub-scales for certain tests with the intention of seeking to identify both individual questions and

broader themes that could be considered to be influential upon the respondents' perceptions of overall satisfaction. These were considered both within each of the individual instances of the survey and across all of the surveys considered collectively. The consideration of the data also took into account the differing question types posed within the questionnaire. There were 4 different question types within the questionnaire that aim to gather responses of different types, whilst still using a Likert scale. The question types can be summarised as follows:

Question Type	Bi-polar scale descriptors	Questions
Quality: *scores relate to perceived quality of an element or area*	1= poor, 7= excellent	7a-f,
Satisfaction: *scores relate level satisfaction with a building feature or issue, based on a single direction of scoring from base point to maximum.*	1= not satisfied, 7 = very satisfied Other descriptors used for specific questions including: 1=unsafe, 7=very safe 1=not easy, 7=easy 1=not accessible, 7=accessible	8,9,11,12,13,14,15, 27, 29, 30, 31, 35, 44, 45, 46
Bipolar Satisfaction (2-way): *scores relate level satisfaction with a building feature or issue, based on a bi-directional score from mid-scale base (neutral) point.*	1= too cold, 7 = too warm 1= too noisy, 7= too quiet 1= too bright, 7= too dark 1= too little, 7= too much etc	16,17,18,19,20,21,22,23, 28, 33, 34, 40, 41, 42, 43,
Significance: *scores relate to significance of a feature or issue to respondents satisfaction*	1=not significant, 7=very significant	10a-e,26, 32, 36, 37,38, 39,

Table 5.4: Classification of questions in AUDE survey by type

The questionnaire also included a number of questions aimed at deriving categorical data from the respondents such as gender, occupation and so on. These were used to provide a basis for group by group analysis of the data to test whether there were differences in responses between respondents from different categorical groups.

Detailed analysis

Section 1: Generic User Information

This section of the questionnaire is intended to gather details relating to the individual users and their use of the building. All users responded to this section in all instances of the application of the questionnaire. The data gathered was used to contextualise the detailed response to individual questions within the whole questionnaire and to allow an overview of the composition of the respondent population set.

Question 1: Gender

Building	Date	Male	Female
Art & Design Academy	2010	24 (42%)	33 (58%)
	2012	13 (32%)	27 (68%)
Tom Reilly Building	2010	48 (51%)	47 (49%)
	2013	20 (47%)	23 (53%)

Table 5.5: Survey respondents by gender

The gender balance within the sample varied slightly between the instances of the application of the survey but the response rate was consistent with the distribution of the overall building population. The largest variation in response rate by gender occurred in the 2013 instance of the ADA survey, when there was a significantly higher proportion of female respondents to the survey (68%).

The Mann –Whitney Test was applied to the data relating to gender to establish whether there was a difference in the overall satisfaction scores (question 8) between male and female respondents. At the $p<0.05$ level there was no significant difference in the satisfaction scores relative to gender in any of the applications of the survey.

Question 2: Occupation

Building	Date	Admin. Staff	Research Staff	Academic Staff	Student	Tech Staff	Other
Art & Design Academy	2010	1 (1.75%)	2 (3.5%)	7 (12%)	44 (74%)	2 (3.5%)	1 (1.75%)
	2012	4 (10%)	1 (2.5%)	11 (27%)	21 (53%)	2 (5%)	1 (2.5%)
Tom Reilly Building	2010	5 (5%)	12 (13%)	15 (16%)	56 (59%)	6 (6%)	1 (1%)
	2013	3 (7%)	5 (12%)	31 (72%)	1 (2 %)	3 (7%)	0 (0%)

Table 5.6: Survey respondents by 'occupation'

The responses generated were distributed between the selected 'occupation' options in a varied pattern. Of particular note is the significant variance in the number of responses received from students in the 2013 TRB survey relative to the other instances. Only 1 response from the total of 43 was generated by a student, equating to 2% of the overall sample. This compares to response rates of between 53% and 74% for the other instances.

The underlying reasons for the poor response from students were explored through discussion with student groups following the closure of the survey. There appeared to be a combination of factors influencing the poor response rate. These were as follows:

- The timing of the survey coincided with the active survey periods fort the National Student Survey, the LJMU internal student opinion survey and the individual module feedback surveys used by the University. Students commented that they were simply weary of the process of completing questionnaires.
- The survey was completed at a time when students were preparing for examinations and they prioritised the survey below more immediate imperatives.
- Although the survey was publicised by email students were not reminded of it after the initial launch and it had been overtaken by other surveys as noted above.

The options that were considered to deal with the unbalanced response were:

- To extend the period of the survey, although this was considered inappropriate as the students had completed their study semester and were away from the University.
- To repeat the survey at a later date to ensure greater student participation. Although this was considered undesirable as it would necessitate a delay of around 4 months and the increased participation could still not be guaranteed.
- To accept the data and proceed, acknowledging its potential limitations. A view on this approach was supported by the outcomes of the earlier statistical tests illustrating that there were few significant differences in the responses to questions between the two participant groups within this instance of the survey. Hence, it was decided to adopt this approach and proceed with data analysis.

In order to test the degree to which overall satisfaction varied between occupancy groups the Kruskall-Wallis test of variance was applied to the overall satisfaction scores for the different groups. At the $p<0.05$ level, there was no significant difference between the scores of the different occupancy groups in relation to question 8, overall satisfaction.

2a: Is this full or part-time

Building	Date	Full-time %	Part-time %
Art & Design Academy	2010	95	5
	2012	84	16
Tom Reilly Building	2010	91	9
	2013	93	7

Table 5.7: Survey respondents by attendance mode

The responses to this question indicated that the number of respondents from all occupancy groups who identified their occupancy as 'part-time' was low, ranging between 5% and 16% of the total respondent sample. The Mann-Whitney test of independence was applied, which indicated that in all cases at the $p<0.05$ level there was no significant difference in scores for overall satisfaction between those within the full-time and part-time classifications.

Questions 3 and 4 allowed respondents to indicate the duration of occupancy within the building per day and the period of time spent using a computer per day.

Question 3: How long do you spend in the building during the day?
Question 4: How long do you spend working at a computer? (average hours per day)

The results for these questions were tested to identify if there was significant variance in response to question 8 (overall satisfaction) between differing response groups using the Kruskall-Wallis test. At the $p<0.05$ level there were no significant differences between those indicating different occupancy durations or patterns of computer usage.

Section 2: Location Information

Questions 5 and 6 allowed respondents to provide information relating to the various locations that they occupy and the duration of occupancy of each area. In addition they were afforded the opportunity to define further, specific locations within the building as the basis for scoring within the overall survey response. The responses to these questions liberated varied and fragmented data regarding additional areas for scoring. Hence the analysis of the questionnaire data was restricted to those areas defined within question 5. (Office, lecture room and laboratory) Question 6 did not identify any further areas that provided sufficient numbers of responses to warrant individual consideration. Responses relating to the areas defined within question five were broken down as appropriate within later sections of the survey. Spearman rho, non-parametric correlation analysis was effected on the responses to questions 5a to 5c, relative to question 8, overall satisfaction. At the $p<0.05$ level there was no significant correlation between occupancy times in specific locations and overall satisfaction.

Question 5 : Location
5.a. Office -- Time in Location(Hours)
5.b. Lecture Room -- Time in Location(Hours)
5.c. Laboratory -- Time in Location(Hours)

Question 6: If you spend any time in any other location type (within this building), please highlight them below

6.a. location 1 -- Location type
6.a.i. location 1 -- Time in Location(Hours)
6.b. location 2 -- Location type
6.b.i. location 2 -- Time in Location(Hours)
6.c. location 3 -- Location type
6.c.i. location 3 -- Time in Location(Hours)

Question 7: Please rate the quality of the following areas (same areas as highlighted in questions 5 and 6)

The responses to the set of questions 7a to 7f were subject to considerable variation in terms of response rate. The differing respondent groups, which included staff, students, technicians and researchers, provided responses that were focused on different, defined areas within the buildings. The nature of this question resulted in the selection of a 'not applicable' response option relating to areas for which they were unable to provide answers. These were dealt with by applying Missing Values Analysis. However, in some instance the extent of the 'not-applicable' responses, relative to the entire potential sample response was such that the MVA was applied to the majority of responses. As such the resulting descriptive statistics are likely to be skewed. The validity of the data was further compromised in the cases of questions 7d to 7f as a result of the respondents being afforded the opportunity to self-define the areas to which their response related. As a consequence, the responses contained within each of these questions were amalgams of responses related to a range of different areas, rather than a single defined area or space.

As a consequence of these issues, the author considered the potential for meaningful analysis of these questions to be compromised to such an extent to warrant their exclusion.

The following sections summarise the descriptive statistics resulting to the individual questions, which are related to named areas or spaces within the buildings. The tables summarise the means and standard deviations for each question, where n is the number of valid response to each question following the exclusion of 'not-applicable' responses.

7.a. Office

The mean response to this question in all instances indicated a rating of the quality of the defined space close to the scale median point of 4. (Appendix 6, table 2) However, in the case of the Tom Reilly building there was a reduction in the satisfaction score between the first and second applications of the survey. In the case of the ADA this was not the case and a slight increase in perceived quality was noted equating to approximately 6.5%, with a reduction of approximately 13% in the case of the TRB. This could be interpreted, simply, to indicate that the perception of quality of the space has varied over time. However, further evaluation and cross referencing to the qualitative information analysis was undertaken to attempt to identify any potential reasons for these changes in perception of quality.

7.b. Lecture room

In the case of both buildings the responses to this question indicated a reduction in perception of quality between the first and second application of the surveys. (Appendix 6, table 3) In the case of the ADA this equated to a reduction of approximately 22%, whilst the TRB results indicated a reduction of approximately 27%. This question solicited the greatest number of responses of any of the questions within the question 7 grouping. As such there were very few 'not-applicable' responses and the application of MVA was not considered to have adversely affected the data. The extent of reduction in perception of quality of the lecture rooms is considerable and the cross referencing to qualitative data was undertaken to attempt to identify potential reasons for the change.

7.c. Laboratory

This question related to the quality of laboratory facilities within the two buildings. In the case of the ADA the nature of the department that is the main occupier of the building is such that the label 'laboratory' could relate to other areas such as workshops and studios. The, responses to this question were low for the ADA with only between 15% and 20% of respondents providing a valid response to the question. (Appendix 6, table 4) As such the data must be considered as potentially compromised for this application of the survey. In the case of the TRB the response rate for this question was high with between 50% and 75% of respondents providing a valid response for the question.

In the case of the ADA both instances of the survey resulted in the mean of the responses being below the median of potential scores. In the case of the TRB the mean sores were significantly above the mid-scale point. However, in both buildings the level of perceived quality reduced in the second application of the survey. In the case of the ADA this equated to approximately a 25% reduction, with a reduction of approximately 20% in the case of the TRB. Once again, cross referencing to the qualitative data relating to these areas was undertaken and is discussed in a later section of the document.

In all instances the respondent numbers for questions 7d to 7f were, with the extraction of the 'not applicable' responses, too small to provide useful data associated with consistently named spaces. Hence, they have been excluded from the analysis and associated narrative. The numbers of responses for these questions relative to overall sample are set out in table 5 of accompanying Appendix 6.

It should be noted that within each of these questions the total number of responses was split between a range of spaces or areas that were self-defined by the respondents. As such the response figures shown for each of the questions may actually need to be broken down further to between 3 and 5 specific, identifiable areas.

The details of the means and standard deviations for data from question 7d to 7f are summarised in tables 6, 7 and 8 of accompanying Appendix 6. Whilst detailed narrative relating to the individual questions has not been included for the reasons noted above,

there is a general indication that overall satisfaction with the areas included has dropped between the first and second iterations of the surveys.

Responses were provided for offices (7a), lecture rooms (7b) and laboratories(7c). In addition, other secondary work areas are scored in questions 7d to 7f but these are not labelled other than 'location 1', 'location 2' etc. The responses to these non-defined areas also included high levels of 'not-applicable' responses, which accounted for between 75% and 88%of the responses for questions 7d to 7f. Hence, they were removed from the overall analysis as they would, in the view of the author, have distorted the statistical analysis. Questions 7a to 7c were tested for linkage to the overall satisfaction question (8) using the Spearman-rho test. The results of these tests are set out in tables 9, 10, 11 and 12 of accompanying Appendix 6.

With the singular exception of question 7a in the 2010 application of the survey in the Tom Reilly building, all instances showed a medium to strong positive correlation between questions 7a-7c and question 8 in all instances of the survey. Questions 7b showed strong positive correlations that were significant at the p=0.01 level in all instances. This indicates that there is a consistent, strong, positive correlation between perceptions of quality of lecture rooms and perceptions of overall satisfaction with the building and a consistent medium to strong positive correlation between perceptions of quality of offices and laboratories and perceptions of overall satisfaction. However, the questionnaire does not define 'quality' and the respondents may have differing views of what the term actually means.

Section 3:

Question 8: How satisfied are you, in overall terms, with the building as a place of work (or study)?

This question is the primary question within the survey that relates to overall perception of quality. For the purpose of the research study this is the dependent variable and the other questions within the survey are analysed against this as independent variables. In addition to the undertaking of analysis to provide descriptive statistics, various

inferential statistical tests were undertaken and correlations were considered between the questions that formed the independent variables and question 8. These are described and discussed in a later chapter.

The mean responses in three of the four instances are above the median point of 4, suggesting a positive perception of the overall building quality. (Appendix 6, table 13) This is not the case in the application of the survey to TRB in 2013, which shows a generally, slight negative perception.

In the case of the ADA there was a slight increase in score between the two survey dates, equating to approximately 2%, whilst the TRB showed a reduction of approximately 20%.

The proportion of responses from each of the user groups is significantly different for this application of the survey from the remaining 3. Only 2% of respondents were students and more than 50% were academic staff. As such it was considered appropriate to review the data relating to this question broken down within user categories to give a summary of results for academic staff and students. The remaining respondent groupings contained too few responses to allow meaningful analysis.

When considered within the defined sub-groups the results for this question showed a difference from the overall scores for the question. (Appendix 6, tables 14 and 15) In the case of academic staff the perception of quality is reduced between the two survey dates in both buildings. This indicates that the apparent overall improvement in perception of quality in the ADA is a consequence of increased scores generated by students.

The Kruskall-Wallis test was applied to this question, which indicated that at the $p<0.05$ level the results in all instances of the survey showed no statistically significant difference in overall satisfaction scores between occupancy groups.

Section 4:

Section 4 of the survey incorporated questions that were broadly related to security within the building and users' perceptions of the various elements that are set out in relation to security and personal safety.

The AUDE questionnaire, which was used in an un-amended form, adopts a likert scale for the majority of questions. The general scale for response adopts descriptors that indicate degree of satisfaction. However, from question 9 onwards there is variability in the adjective labels for the scale. From question 10 onwards the level of significance of the issue to the respondent's perception of satisfaction is introduced. Hence, some questions from this point on ask the respondents to express their views on how significant the issue is to their satisfaction. Not how satisfied they are with the issue. This introduces an element of uncertainty to the analysis of the data as there is the potential for a respondent to consider an issue highly significant, thus deriving a score of 7, yet actually be quite dissatisfied with that issue. In analysis of those individual questions this would be invalid if the intention was to gauge satisfaction rather than perception of significance. However, if the approach that is taken is that the initial question is the indicator of satisfaction and that subsequent questions allow expansion of the reason for satisfaction there may be more scope for drawing clear conclusions.

Question 9: Personal Safety: How safe do your feel in the building?

The scores for all instances of the survey were above the median, suggesting a moderately positive perception of security and feeling of personal safety within the building. (Appendix 6, table 16) All of the respondents to the surveys provided responses to this question. In both buildings there was a moderately to strong positive perception of safety although in both cases there was also in a reduction in feeling of safety between the two applications of the survey. In the case of the ADA this equated to only 1%, whilst the TRB showed a reduction of 20%.

The question attempts to gauge general perceptions of safety and is supplemented by question 10, which includes more specific elements that combine to create the general

perception. Conclusions about actual satisfaction with security cannot legitimately be drawn from analysis of these questions for the reasons stated above.

Question 10: Security: What aspects of the environment contribute to feeling safe?

Question 10 is broken down in to 5 sub-questions, each addressing a specific component of the overall issue of safety and security. Some of the components referred to in this section also feature in other sections of the questionnaire in a slightly different context, such as lighting and spatial configuration. Cross referencing of the results for these sections was undertaken to assess whether there was a consistency in response between the different questions.

10.a. Visibility of security personnel

The responses to this question showed a clear difference in perception between the two buildings. (Appendix 6, table 17) The results for the ADA were slightly above the median level, suggesting a slight positive linkage between visibility of security personnel and feeling of safety in both applications of the survey. In contrast the TRB results were slightly below the median, suggesting a weaker view of significance of this factor. In both buildings the scores were reduced in the second application of the survey. In the case of the ADA reduction of approximately 7% was experienced with the TRB reduced by only around 1%.

10.b. Access control to the building

In all instances the results showed a moderately positive response to this question with a strong positive score in the 2010 application of the survey in the TRB suggesting that this factor is seen as highly significant to overall perceptions of safety and security. (Appendix 6, table 18) The data when tested using Spearman rho showed significant positive correlation with overall perception of safety at the $p<0.01$ level. However, this score reduced by approximately 25% on the second application in the same building, showing a weak positive correlation that was not significant at the $p<0.05$ level. The second, lower score is closer to the general pattern of scores for this and other questions, suggesting that the earlier score of 6.21 is out of trend with the general

pattern of scoring. The score for this question, however, relates to significance of the issue, not to satisfaction. A cross referencing exercise to the focus groups and qualitative interviews was undertaken, which showed a high degree of frustration with access control and zoning to the building in the early part of its occupancy.

10.c. Security zoning (access control to parts of the building)

This question liberated results that indicated a slight positive perception of the significance of security zoning with the ADA increasing by approximately 7% in the second application, whilst the TRB results showed a slight decrease in significance of approximately 6%. (Appendix 6, table 19)

10.d. Lighting

This question liberated responses that indicated a slight positive perception of significance with means slightly above the median in all cases. (Appendix 6, table 20) The pattern of response was similar to previous questions with increasing satisfaction relating to the ADA and decreasing satisfaction relating to the TRB. The responses to this question from students within the ADA were significantly more positive than those of staff and this is the main reason for the increased score for the 2012 application of the survey. The results are also generally more positive than for other questions within the survey that deal with the issues around lighting and light. This question did not show any significant correlation with overall perception of safety in any of the instances of the survey.

10.e. Spatial configuration (i.e. relatively large uncluttered spaces)

Once again there appears to be a slight positive response in all instances for this question. (Appendix 6, table 21) However, in the case of the TRB this is a very marginal score which is only 0.02 above the median. The other instances show a similar pattern of response to the previous question with increasing satisfaction in the ADA and decreasing satisfaction in the TRB.

The nature of question 9 relating to perceived safety and security is that is linked to the questions immediately following it, questions 10a-10f, which gather responses relating to respondents views on the significance of specific security & safety related factors. It is possible that the respondents see these as a set of linked questions that expand upon their response to question 9. However, it is also possible that they see them as unrelated individual questions. It is not possible to gauge which of these is the most likely. However, consideration of the descriptive statistics relating to each of the questions 10a- 10f was effected along with the other 'Significance' questions from the survey to attempt to identify the extent to which the factors identified are considered significant by the respondent sample.

Examination of linkage between perceived significance of the various factors identified within question 10 and perceptions of security and safety as scored in question 9 were tested using the Spearman rho non-parametric coefficient of correlation. Within individual instances of the survey correlations between each of the sub-questions within question10 and the score for question 9 varied with no consistent pattern of significance being observable across all instances of the survey. The results for these tests are summarised in tables 22 to 25 of accompanying Appendix 6.

Question 11: How accessible is the building from the street, i.e. to the reception door?

The responses to this question showed a strong positive perception in all instances. (Appendix 6, table 26) The pattern of response that has been noted in reference to earlier questions is repeated in that there is a slight increase in satisfaction in the case of the ADA whilst the TRB surveys indicate a reduction in satisfaction between the 2010 And 2013 surveys.

Question 12: How easy is vertical circulation? (How easy is it to move between floors?)

The responses relating to the issue of vertical circulation suggested a greater degree of satisfaction in the ADA relative to the TRB. (Appendix 6, table 27) The ADA showed a strong positive perception in respect of this issue, with the TRB showing moderately strong positive perception. Once again there was also a reduction in the score in the case of the TRB, whilst the ADA showed an increase in perception of satisfaction. The

issue of circulation within the building is linked to the issue of security zoning and the cross referencing to the qualitative elements of the research suggested that the TRB was subject to difficulties associated with accessibility due to the nature of the security/access zoning, rather than as a direct result of the accessibility design elements.

Question 13: How easy is horizontal circulation? (How easy is it to move about on each floor?)

The pattern of results that were generated in relation to vertical circulation within the buildings were echoed in relation to horizontal circulation. (Appendix 6, table 28) The general pattern of improvement in the ADA and reduction in TRB between the survey applications was repeated.

Question 14: How clean is the building?

Although this question liberated results that showed a strong positive perception to the issue of cleanliness within the buildings there was a reduction in the scores for both buildings between the first and second application of the surveys. (Appendix 6, table 29) In the case of the ADA there was a 5% reduction, with a reduction of around 8% in the case of the TRB. This is one of a small number of questions in which the scores for ADA were reduced on the second application of the survey. It is also noted that there was a relatively low standard deviation associated with the responses to this question, suggesting that the general, consistent perception is positive. When the data was tested for correlation between responses to individual questions and scores for overall satisfaction this was the only question that showed significant correlation at the $p<0.05$ level, suggesting that perceptions of cleanliness are influential upon perceptions of overall satisfaction with the building.

Section 5: Communal Areas

The questions in this section all relate to issues of indoor environmental quality within the communal areas of the building. The earlier review of the literature suggested that

these issues were considered by many commentators to be among the most significant in relation to overall satisfaction. The qualitative interviews with Directors of Estates also supported this view. Elements associated with the broad areas of heat, light, air quality and acoustics are grouped together within this section. The questions are repeated subsequently within the survey in the context of other specific areas of the building.

The bi-polar adjective scales that are used to generate response for this section shift away from measures of satisfaction or significance to apply descriptors to the various issues. Hence, the respondents are asked to give scores that relate to two varying descriptor statements, not to satisfaction or significance in a positive/negative sense. As such, assessment of satisfaction is difficult to measure accurately. The assumption is that a median score might reflect satisfaction, whilst higher or lower scores reflect dissatisfaction for differing reasons. However, this is not the case consistently. For example question 15, relating to air quality gives the options in the range of '7=fresh' or '1=stale'; it can be justifiably interpreted that higher scores mean greater satisfaction. However, question 16, relating to humidity, offers respondents options in the range '1=too humid' to '7=too dry; the measure of satisfaction in this instance being' neither too humid nor too dry' thus at the mid-point of the scale. This variance in descriptor between individual questions poses significant issues in the statistical analysis of the data. The qualitative elements of the research also liberated data that suggested a tendency to derive confused responses from building users, who tended to default to a response pattern for all questions in which '1=bad; 7=good'. As such the data gathered by the questionnaires was considered by the author to be potentially compromised. However, detailed analysis was undertaken with a view to gaining insight into the basis of responses and the patterns and trends that potentially emerge.

Question 15: Is the air fresh or stale?

Moderately strong, positive scores were generated for both buildings and both applications of the survey. (Appendix 6, table 30) As noted above, this could be interpreted to mean that in both buildings the air is relatively fresh and, thus provides appositive indicator of satisfaction. Once again the pattern of improved scores within

ADA and reduced scores in TRB was repeated with ADA increasing by approximately 2% and TRB reducing by around 7%.

Question 16: Is the air humid or dry?

This question introduces the use of bi-polar qualitative descriptors to allow users to respond to the question, which relates to humidity levels in the air. The scores are consistently within 1 scale point of the mean and display low standard deviation figures, suggesting a relatively consistent response pattern. (Appendix 6, table 31) In terms of the degree to which the scores reflect satisfaction or perceptions of satisfaction, the use of the descriptor labels suggests that a score at the median point reflects maximum satisfaction, whilst scores above or below this represent, equally, degrees of dissatisfaction. However, the trend in the direction of travel of the scores is similar to those experienced in earlier questions ranking positive/negative satisfaction with a reduction in the score for the TRB of around 3% with an increase for the ADA in the region of 6%.

Question 17: Does the air smell?

Scores for this question tended towards a strong, positive perception, assuming that 'no smell' is a measure of satisfaction and that 'smelly' is a measure of dissatisfaction. The trend for both buildings was to show an increase in the scores between the first and second iterations of the surveys. In the case of the ADA this equated to approximately 10%, with the TRB result showing a lower level of increase at approximately 2%. (Appendix 6, table 32)

Question 18: Is the temperature in winter too cold or too warm?

This question liberated responses that suggested a degree of dissatisfaction with the thermal characteristics of the buildings. In all but one of the instances of application of the survey the responses indicated a perception that the buildings were too cold in winter; although the responses were all within 1.05 scale points of the median. (Appendix 6, table 33) The singular exception to this was the result for the 2010 TRB application of the survey, which was 0.2 scale points away from the medial score.

Question 19: Is the temperature in summer too cold or too warm?

The mean responses to this question liberated means that were all within 1 scale point of the median, suggesting a general level of satisfaction with the thermal characteristics of the buildings in summer but with a consistent slight view that the buildings are too warm. The standard deviations and maximum/minimum score ranges also indicated a general consistency in the scoring for this factor. (Appendix 6, table 34)

Question 20: Is this area of the building too noisy or too quiet for your liking?

The responses to this question all fell within 0.5 scale points of the median suggesting a broad level of satisfaction across all of the instances of the surveys. (Appendix 6, table 35) The general observation would be that the buildings are generally considered to be slightly too noisy, with the exception of the 2013 survey relating to TRB, which showed a mean score suggesting that it was perceived as slightly too quiet. The distribution of scores showed a consistent pattern with few extreme scores in any of the instances.

Questions 21, 22 and 23 all relate to the general theme of light and lighting. In addition to consideration of the scores for individual questions the responses were considered as a themed group of questions when subjected to statistical testing to assess potential linkages with overall satisfaction. The results of these tests are discussed in a later section of the analysis.

Question 21: Is this area of the building well lit?

The mean scores for this question are clustered close to the median point and are all within 0.22 scale points of the median. (Appendix 6, table 36) This suggests a very neutral perception of this factor with a general perception that the buildings do not suffer significantly from excessive brightness or darkness.

Question 22: Is there too much or too little natural light?

All means of responses to this question fell within 1 scale point of the medial score, with standard deviations indicating relatively consistent scoring within each of the survey applications. (Appendix 6, table 37) The results for the two buildings differed in both the first and second applications of the survey with the ADA being considered as having slightly too much natural light and the TRB being considered as having slightly too little.

Question 23: Is there too much or too little artificial light?

The mean scores for all instances of this question indicated a consistent result suggesting that users perceive there to be slightly too much artificial light in the communal areas of the buildings, in all instances of the survey. (Appendix 6, table 38) The mean scores all fell within 0.75 scale points of the medial score, with standard deviations of less than 1.25 scale points suggesting modest variation in the scores for this question.

Question 24: Please provide any comments about the communal areas of this building. This may include factors that have not been highlighted in the questions above.

This question is considered within the qualitative analysis section of the thesis.

Section 6: Location Specific Environmental Conditions; Primary work area

The questions within this section required the respondents to give scores related to perceptions of significance of individual factors upon overall satisfaction as well as scores relating to satisfaction associated with individual factors. The responses relate to the primary work areas defined by the respondents and several of the questions are direct repeats of those applied earlier in the questionnaire in the context of communal areas or the building as a whole.

Question 25: Please select work area type

This question allowed respondents to select their primary work area from a pre-defined list of Office, Lecture room and Laboratory, supplemented by the self-defined options included by the respondents in the earlier questions 5 and 6 of the questionnaire. Due

to the low number of additional areas defined within the data analysis of this section was restricted to the options of Office, Lecture Room and Laboratory. All respondents cited one of these options to be their primary work area in all instances of the survey.

Questions 26 to 31 are broadly related to air and air quality. In addition to their analysis as individual responses they were considered within a new combined variable with particular reference to establishing correlation or linkage with overall satisfaction. This is discussed in a later section of the thesis.

Question 26: Does the quality of the air in this part of the building have a negative effect on your work performance?

The mid-scale point of 4 represents the neutral score for this question. In all instances of the survey the means of respondents' scores were within 0.6 scale points of the mid-point. (Appendix 6, table 39) This suggests that there is not a strong perception of significance of air quality upon overall satisfaction on the part of respondents generally.

Question 27: Is the air fresh or stale?

There was some very slight variation in the scores between the different areas identified by respondents as their primary work area, although when tested using the Kruskall Wallis analysis of variance test there was no significant difference at the $p<0.05$ level. Hence, the responses for this section were considered as a collective set of data relating to 'primary work' area rather than as individual data sets for offices, lecture rooms and laboratories. (Appendix 6, table 40) The mean scores in all instances of the survey indicated a general perception that the air was considered slightly 'fresh' rather than stale. This is interpreted as being a positive score on the basis that fresh air would generally be considered more favourably than stale air.

Question 28: Is the air humid or dry?

The mean scores for this question were all clustered within 0.65 scale points of the mid-scale or neutral point. (Appendix 6, table 41) The standard deviation was consistent between the various applications of the survey at around 1 scale point. The observable

broad conclusion of this data is that there is a consistent, slight perception that the air within the buildings is too dry.

Question 29: Does the air smell?

The means of the responses to this question indicated that there was a consistent positive perception indicating that the air is generally considered to be without smell. (Appendix 6, table 42) All mean responses were in excess of 1.15 scale points above the median.

Question 30: Is there air movement?

In all instances of the survey the mean responses to this question were slightly above the mid-scale point, suggesting a generally slightly positive perception of the issue of air movement. (Appendix 6, table 43)

Question 31: Do you have control over ventilation?

The mean scores for this question give an indication that there is a general perception of a limited level of control of ventilation. (Appendix 6, table 44) The distribution of responses was large in all instances of the survey with standard deviations ranging between 1.76 and 2.40 scale points the maximum and minimum scores experienced indicated that there was a degree of polarisation of the responses in this question.

Question 32: Does the temperature in this part of the building have a negative effect on your work performance?

The mean responses for this question varied between the two subject buildings in both the first and second iterations of the survey. (Appendix 6, table 45) In both applications of the survey within the ADA the mean sores indicated that the perceptions of respondents were that the issue had significant impact upon their performance, the implication of this being that they displayed a degree of dissatisfaction with this factor. The 2010 instance of the survey within the TRB was not consistent with the rest of the

results in that the scores suggested that respondents were moderately satisfied with the noise levels and that noise did not impact heavily upon their work performance. However, the distribution of scores within this question was relatively large with standard deviations ranging from 1.86 to 2.13 scale points. Combined with the analysis of maximum and minimum scores for this question, the broad STD range indicates a lack of consistency in view on the parts of the respondents for this question, with considerable variability of score being noted.

Question 33: Is the temperature in winter too cold or too warm?

There was a consistent slight perception that the buildings were too cold in winter with three of the four instances of the survey showing mean below the mid-scale point. (Appendix 6, table 46) In the case of the 2010 TRB survey, however, the mean of responses indicated a neutral perception with the figure of 4.02 suggesting a general level of satisfaction amongst respondents. However, the scoring range was relatively high in the both of the survey applications within the ADA, indicating a high degree of variability in perception of this issue depending upon the location that was specified as the primary work area. SPSS was used to test for correlations between the scores for this question and the scores associated with perceived quality for defined areas (question 7). The test showed no pattern of correlation in any of the survey applications.

Question 34: Is the temperature in summer too cold or too warm?

The responses in all cases indicated that the general perception was that the buildings were slightly too warm in summer, with all means being above the mid-scale point. (Appendix 6, table 47) In the case of the 2013 TRB survey the mean was within 0.05 scale points of central and could be considered as a neutral mean response, indicating general satisfaction with the thermal characteristics of the building in summer. There were considerable levels of variability within the scores for this question indicating some differentiation by selected area and a degree of variability in response within the same area.

Question 35: Do you have control over heating?

The results for this question showed an unusual pattern across the four applications of the survey. (Appendix 6, table 48) The general pattern of responses in three of the survey applications showed a consistent perception of lack of control over the heating within the building. The exception to this was the 2013 application of the survey in the TRB, which showed a slightly positive mean response. This application of the survey suffered from a very low level of student response and the mean score was derived from staff only. As a consequence, it was posited that there was the possibility that staff perceived that they had higher level of control over heating than did the student respondent group. In order to test this the Kruskall Wallis test was applied using SPSS to test for variance in response between groups. The results for these tests are set out in tables 49 and 50 of accompanying Appendix 6.

In both applications of the ADA survey there was no significant difference (at the $p<0.05$ level) in the response to this question between the various defined occupancy groups. In the case of the TRB 2013 survey there were too few student responses to allow the test to be effected, however, in the TRB 2010 survey the outcome was that at the $p<0.05$ level there was a statistically significant variance in scores for this question across groups. This showed that Academic staff had the highest mean score, showing a high perceived level of control and the technical staff having the lowest level of control with students having the next lowest level of control.

Question 36: Does the distraction from noise in this part of the building have a negative effect on your work performance?

With the exception of the ADA 2010 application of the survey all of the mean responses fell below the scale mid-point, suggesting that noise did not create distraction in the primary work area for the respondents. (Appendix 6, table 51) There was considerable variation in the scores for this section and the pattern of response, both between buildings and between survey applications varied considerably. However, there was no significant variance in response between occupancy groups or gender at the $p<0.05$ level.

Question 37: Is there significant distraction from noise outside the space?

The range of scores within each of the applications of the survey was considerable with standard deviations close to 2 scale points away from the mean. (Appendix 6, table 52) This indicates a high degree of variability in the perception of respondents to this question. However, the mean scores fall below the mid-scale point in all instances suggesting that the general perception is that noise from outside the space does not contribute negatively to the users' experience of the building.

Question 38: Is there significant distraction from background noise?

The results for this question varied between applications of the survey, with three of the four instances generating mean scores below the mid-scale point, indicating general satisfaction with the issue of background noise disturbance. (Appendix 6, table 53) Whilst there was a relatively wide distribution of responses to the question, with standard deviations close to 2 scale points from the mean for all instances, there was no statistically significant difference in scores between respondent groups. The 2010 application of the survey in the ADA showed a very slight level of dissatisfaction with the issue but the score was only 0.12 scale points above the neutral level.

Question 39: Does the quality of light in this part of the building have a negative effect on your work performance?

The results for this question showed means close to the mid-scale point suggesting a general level of satisfaction. However, the results varied between buildings, with the ADA being considered to have light levels that have a slight negative effect upon user satisfaction. (Appendix 6, table 54) The TRB surveys indicated a generally neutral response to the issue. However, in both buildings there was a wide range of scores, with standard deviations close to and in excess of 2 scale points from the mean. This suggests that there is a wide range of responses in the survey sample.

Question 40: Is there too much or too little natural light?

All means for this question were within 1 scale point of the mid-scale and the standard deviations were relatively contained, indicating a general clustering of responses around the neutral or mid-scale point. (Appendix 6, table 55) This could be interpreted to indicate broad satisfaction with the issue of natural light in all survey instances.

Question 41: Is there too much glare from the sun / natural light?

The responses to this question generated means that were within 0.4 scale points of the mid-scale and the standard deviations were contained, indicating a strong clustering of responses around the neutral or mid-scale point. (Appendix 6, table 56) This suggests broad satisfaction with the issue of glare from natural light in all survey instances. However, the scale is subject to some uncertainty in definition and several of the qualitative responses collected during the research commented on the notion of assessing 'too little glare' since the presence or otherwise of this factor could be deemed to be a nominal variable (glare or no glare) rather than an interval variable (Likert scale) as represented in the questionnaire.

Question 42: Is there too much or too little artificial light?

In all applications of the survey the means for this question were within 1 scale point of the mid-scale and the standard deviations were, again, relatively contained, indicating a general clustering of responses around the neutral or mid-scale point. (Appendix 6, table 57) This could be interpreted to indicate broad satisfaction with the issue of artificial light in all survey instances. However, the resultant mean scores are all above the neutral or mid-scale point, which could be interpreted as indicating a slight perception that there is too much artificial light.

Question 43: Is there too much glare from artificial light?

The comments made previously in relation to question 41 are reiterated in respect of this question. The mean response for all applications of the survey suggest a slight perception of there being too much glare from artificial light. (Appendix 6, table 58)

Question 44: Are the blinds / shutters / curtains effective in blocking out natural light?

Whilst there was a relatively wide range of responses, as illustrated by standard deviations of around 2 scale points from the mean, the overall mean scores in all instances give the general perception of a high degree of satisfaction with the issue of blinds and blackout facilities, with mean scores all in excess of 1.6 scale points above the mid-scale. (Appendix 6, table 59)

Question 45: Do you have control over artificial lighting?

The mean responses to this question were consistent with means for all instances of the survey within 0.5 scale points of the mid-scale point. (Appendix 6, table 60) There was a degree of variability in the scores, as illustrated by standard deviations close to 2 scale points from the mean. However, there was no statistically significant variation in scores for this question between respondent groups are gender. Generally the scores close to the neutral point suggest a moderate degree of satisfaction with this factor in all instances of the survey.

Question 46: Is the electronic data projection equipment effective?

As with question 44, there was a relatively wide range of responses, as illustrated by standard deviations of around 2 scale points from the mean. (Appendix 6, table 61) However, the overall mean scores in all instances give the general perception of a high degree of satisfaction with the issue of blinds and blackout facilities, with mean scores all in excess of 2.25 scale points above the mid-scale.

Question 47: If you have any comments about your primary work area, please feel free to provide them in the space below.

Section 7:

Detailed analysis of the responses for section 7 of the survey were omitted from the research due to the high number of null responses as previously described.

Section 8:

Question 71: If you have any additional comments that you would like to make about any aspect of your work environment please note them here. If you feel there are other aspects that contribute to the work environment, that have not been covered in this survey, please highlight them here.

Analysis overview

Correlation

Within the data that resulted from the AUDE surveys it was necessary to analyse correlations and linkages between individual questions and between sub-sections of the survey in order to identify the critical satisfaction indicators within the survey. It was also intended to analyse correlations between responses to individual questions or sub-sections and overall satisfaction. However, the non-normal distribution of the data prevented the undertaking of parametric correlation analysis using Pearson's test of correlation and instead the non-parametric alternative, the Spearman-rho test, was applied.

One of the main aims of the research was to attempt to identify the key characteristics or issues that affect user satisfaction. The consideration of linkages between question 8 'overall satisfaction' and a range of independent variables represented by the questions within the survey could not be effected using SPSS tests for correlation due to the requirement that such tests are applied to data displaying normal distribution. As a result an alternative non-parametric approach was necessitated. Consequently the Spearman rho test was applied as a non-parametric alternative to correlation analysis.

The main purpose of undertaking this test was to assess which factors showed a linkage or correlation of score with the 'overall satisfaction' question (8). The tests were conducted in batches with the 'quality', 'satisfaction' and '2 way satisfaction' questions dealt with as separate groups.

The results for the Spearman rho correlation coefficient are presented in the following sections.

Quality Questions:

Figure 5.2 below illustrates the distribution of mean scores for the questions that relate to the concept of quality within the questionnaire. The pattern of response is broadly consistent between the four instances of the survey with questions 7a (offices) and 7c (laboratories) having higher mean scores than that of question 7b (lecture rooms). This suggests that, in general terms, the respondents' perceptions of the quality of lecture rooms was lower than that for offices and laboratories.

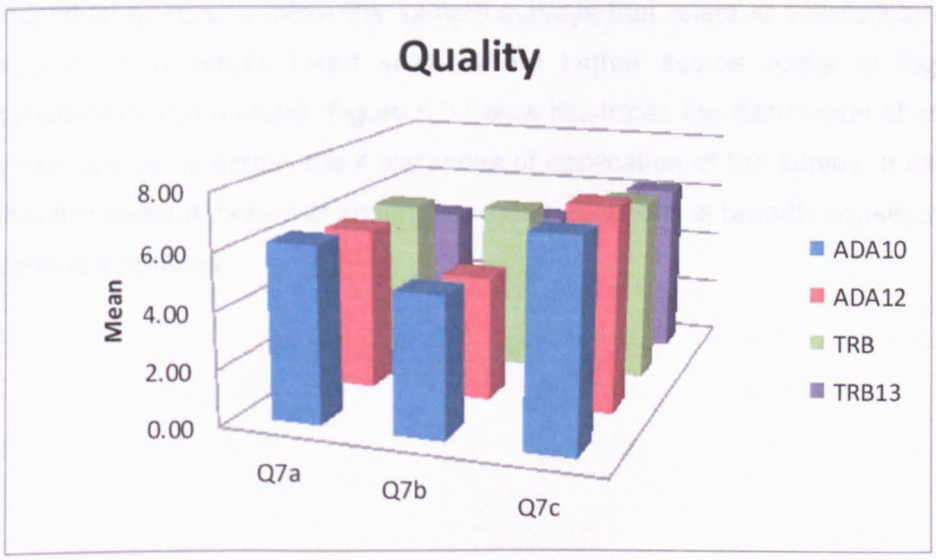

Figure 5.2: Mean values for responses to questions based on perception of quality

The correlation analysis for the questions focused on 'quality ' indicated that there were significant correlations between perceptions of quality of individual areas and overall satisfaction with the building. In particular question 7b relating to lecture rooms showed a strong positive correlation, at the $p<0.01$ level, with overall satisfaction in all instances of the survey. Question 7a (offices) also showed a strong positive correlation at the $p<0.01$ level in three of the fours instances, whilst question 7c showed strong positive correlation at the $p<0.05$ level in two cases and a strong positive correlation at the

$p<0.01$ level in a further instance. These results are summarised in tables 62 to 65 of accompanying Appendix 6.

The results suggest that there is a consistent and potentially generalizable linkage between perceptions of 'quality' individual spaces and perceptions of overall satisfaction with the building. However, this should be considered with some degree of caution as the definition of the term 'quality' may be subject to considerable variability between user groups and between individual contexts.

Satisfaction Questions:

In addition to question 8, related to overall satisfaction with the building, there are 14 individual questions within the sample surveys that relate to satisfaction and which are scored on a simple Likert scale where higher scores relate to higher perceived satisfaction with a factor. Figure 5.3 below illustrates the distribution of mean scores for these questions across the 4 instances of application of the survey. It can be observed that the general pattern of scoring for these questions is broadly consistent between the various instances.

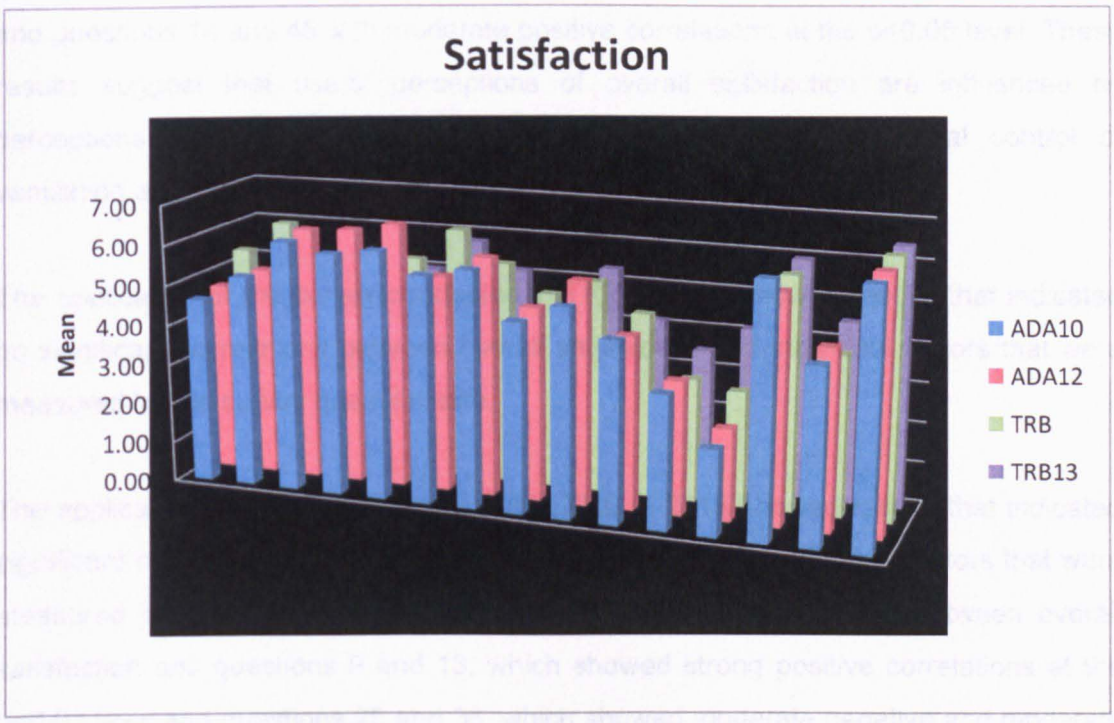

Figure 5.3: Mean values for responses to questions based on satisfaction

The relationship between overall satisfaction with the building and individual factors within the questionnaires indicated a range of correlations between independent variables and the dependent variable (question 8). The pattern and strength of these correlations varied between instances of the survey application as illustrated in tables 66 to 69 of accompanying Appendix 6.

In the ADA 2010 survey four factors showed significant correlation with overall satisfaction. These were questions 9, 14 and 27, which showed medium to strong positive correlation at the $p<0.01$ level and question 12 which showed a medium positive correlation at the $p<0.05$ level. These results suggest that in this application of the survey, respondents perceptions of overall satisfaction were influenced by perceptions of personal security, ease of vertical circulation, building cleanliness and air quality (freshness) in the primary work area.

The ADA 2012 application of the survey showed significant correlations between overall satisfaction and questions 9 and 31 with strong positive correlations at the $p<0.01$ level

and questions 14 and 45 with moderate positive correlations at the $p<0.05$ level. These results suggest that users' perceptions of overall satisfaction are influenced by perceptions of personal safety, cleanliness of the building, personal control of ventilation and personal control over lighting.

The application of the survey conducted in TRB in 2010 showed results that indicated no significant correlations between overall satisfaction and individual factors that were measured by the survey questionnaire.

The application of the survey conducted in TRB in 2013 showed results that indicated significant correlations between overall satisfaction and four individual factors that were measured by the survey questionnaire. Correlations were observed between overall satisfaction and questions 9 and 13, which showed strong positive correlations at the $p<0.01$ level and questions 28 and 35, which showed moderate negative and moderate positive correlations respectively at the $p<0.05$ level. These results suggest that, in this instance, overall satisfaction is influenced by perceptions of personal safety, ease of horizontal access and air quality (humidity) and perceptions of control of heating in the primary work area.

Only question 9 showed a correlation with overall satisfaction in all four applications of the survey, suggesting that there is a generalizable conclusion that perceptions of personal safety influence users' perceptions of overall satisfaction.

Bi-polar (2-way) Satisfaction Questions

There are 15 individual questions within the sample surveys that relate to satisfaction and which are scored on a bipolar Likert scale where scores are based around the neutral mid-point and where higher, or lower scores relate to perceived dissatisfaction with a factor. Figure 5.4 below illustrates the distribution of mean scores for these questions across the 4 instances of application of the survey. It can be observed that the general pattern of scoring for these questions is broadly consistent between the various instances.

Scores that deviate significantly from the mid-scale point are considered to reflect directionally specific elements of dissatisfaction. The pattern of mean scores showed only three questions with observable variance from the mid-point to an extent that would warrant commentary. These are questions 17, which consistently scored above the mid-scale, suggesting that air quality was consistently considered to be 'without smell' and questions 18 and 33, (both of which relate to temperature in winter) which scored consistently below the mid-scale indicating a general perception that the buildings are too cold in winter.

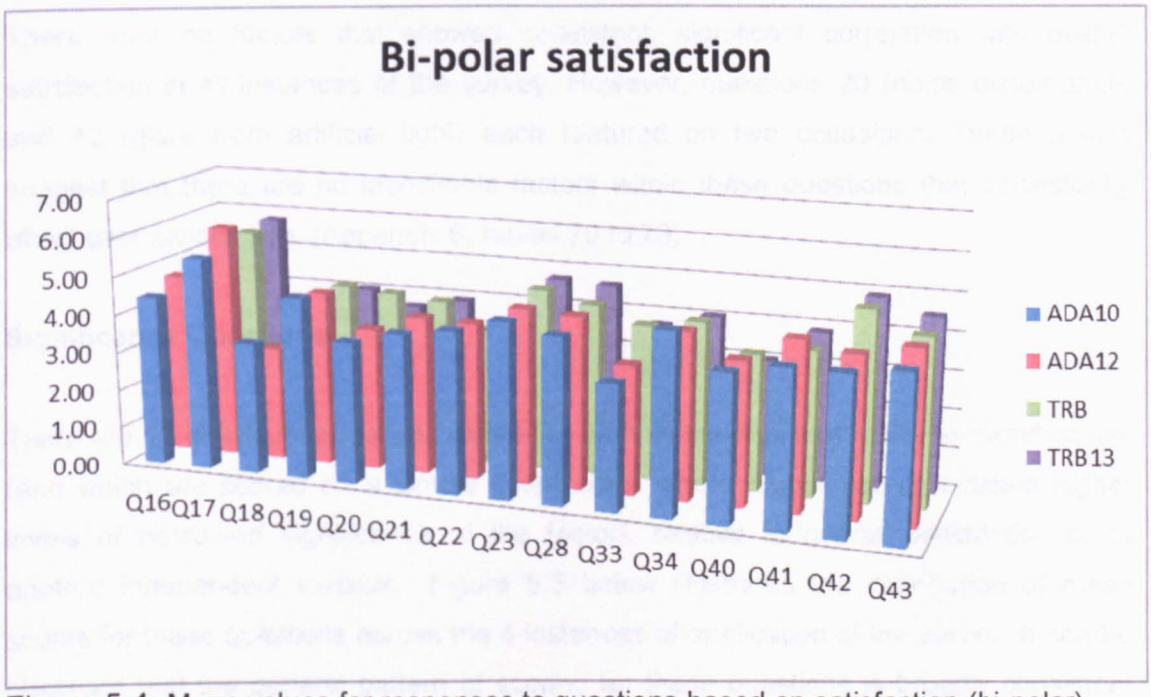

Figure 5.4: Mean values for responses to questions based on satisfaction (bi-polar)

The 2010 application of the survey liberated results that showed low, positive correlation between overall satisfaction and question 20 at the $p<0.05$ level, with a low negative correlation with question 43, also at the 0.05 level. These questions relate to noise disturbance and glare from artificial light.

This application of the survey suggested strong positive correlations at the $p<0.01$ level between overall satisfaction and questions 18, relating to temperature in winter, and question 20, relating to noise disturbance.

The application of the survey conducted in TRB in 2010 showed results that indicated no significant correlations between overall satisfaction and individual factors that were measured by the survey questionnaire.

In the 2013 application of the survey in the TRB moderate negative correlations, significant at the $p<0.05$ level, were indicated between questions 28 and 43 and overall satisfaction. These results suggest that air quality (humidity) and glare from artificial light are factors affecting users' satisfaction in this instance.

There were no factors that showed consistent, significant correlation with overall satisfaction in all instances of the survey. However, questions 20 (noise disturbance) and 43 (glare from artificial light) each featured on two occasions. These results suggest that there are no identifiable factors within these questions that consistently affect user satisfaction. (Appendix 6, tables 70 to 73)

Significance Questions

There are 11 individual questions within the sample surveys that relate to 'significance' (and which are scored on a simple Likert scale where higher scores indicate higher levels of perceived significance of the factor), relative to overall satisfaction or to another independent variable.. Figure 5.5 below illustrates the distribution of mean scores for these questions across the 4 instances of application of the survey. It can be observed that the general pattern of scoring for these questions is broadly consistent between the various instances. (Appendix 6, tables 74 to 77)

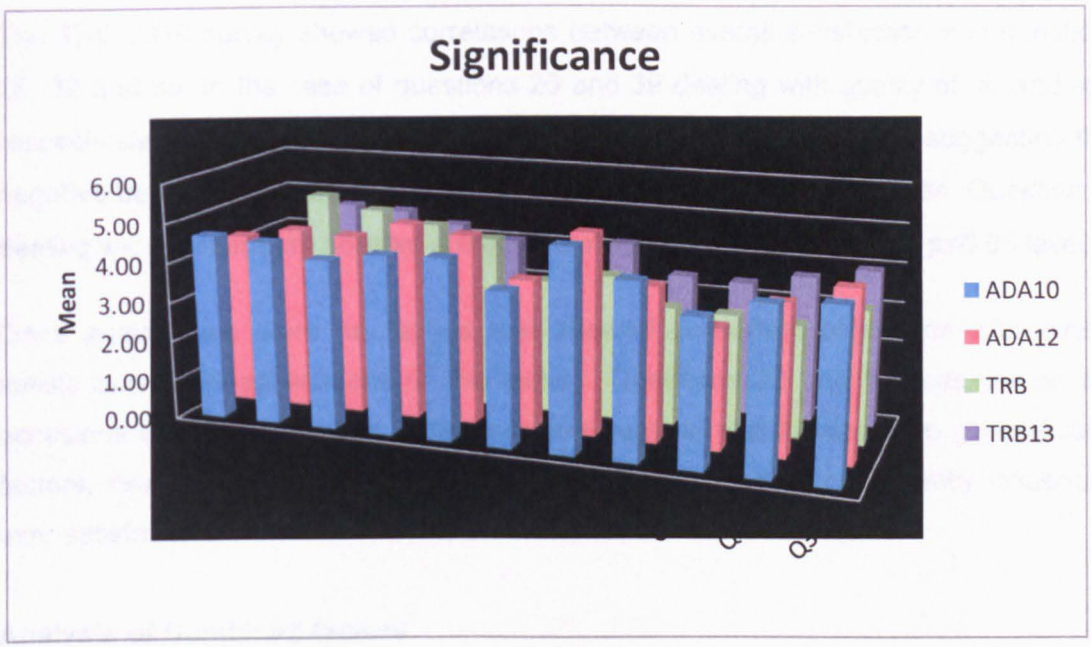

Figure 5.5: Mean values for responses to questions based on perceived significance

In the 2010 application of the survey within the ADA, the only factor that showed correlation with overall satisfaction was question 39, which showed a moderate negative correlation at the $p<0.05$ level. This indicates that low scores relating to the extent to which the quality of light is perceived to impact negatively upon the workplace, have a positive effect upon users' perceptions of overall satisfaction. However, the interpretation of this is complicated by the double negative phraseology of the question.

The 2013 application of the survey liberated results that indicated strong positive correlation at the $p<0.01$ level with question 32, relating to impact of temperature upon overall performance. In addition moderate positive correlations were noted in the case of questions 26 and 3, dealing with air quality and background noise respectively.

The TRB 2010 application of the survey indicated a low negative correlation with question 10d (lighting levels relative to perceived security) relative to overall satisfaction. This was significant at the $p<0.05$ level.

The TRB 2013 survey showed correlations between overall satisfaction and questions 26, 32 and 39. In the case of questions 26 and 39 dealing with quality of air and light respectively, the correlations were strong, negative at the $p<0.01$ level suggesting that negative perceptions of these factors contributes to overall dissatisfaction. Question 32 dealing with temperature showed a moderate negative correlation at the $p<0.05$ level.

Once again there were no factors that showed consistent correlation with overall satisfaction in all applications of the survey. Questions 32 and 39 featured on two occasions but the conclusion of this analysis suggest that there are no generalizable factors, identified within the survey that could be identified as consistently influencing user satisfaction.

Analysis of Combined factors

As part of this process groups of questions relating to similar issues were grouped together to assess the correlation between themed issues and overall satisfaction. For example, all of the individual questions relating broadly to the theme of light and lighting were considered individually and as part of a themed group. The large number of questions within the survey made the testing for correlation in a single batch cumbersome. Hence, the questions were analysed in batches to allow for more easy presentation and interpretation of the results. This process was repeated for all four instances of the survey application.

The responses to individual questions were transformed in to a range of new thematic variables to represent the combined means of the individual questions. The themes were selected based upon the existing questionnaire structure and informed by the insight gained from the literature review and pilot interviews relating to perceived significant factors affecting user satisfaction. As a result the themes selected for the new, combine variables related to elements of internal environmental quality within the buildings. These were noted in the early part of this chapter along with a breakdown of the questions that were noted to contribute to each. However, in undertaking analysis of the various combined variables it was essential, also, to reflect the different question forms of 'quality', 'significance', 'satisfaction', and 'bi-polar satisfaction' in order to effect valid statistical analysis.

As such the themes were considered by analysing clusters of questions within the structure set out in table 5.8 below.

	Satisfaction	Bipolar Satisfaction	Significance
Safety/security	9		10a, 10b,10c, 10d, 10e
Light/lighting	44, 45	21, 22, 23,40, 41, 42, 43	39
Accessibility/movement	11, 12, 13		
Air quality	15, 27, 29, 30, 31	16, 17, 28,	26
Heat/Ventilation	35	18, 19, 33, 34	32
Noise		20,	36, 37, 38

Table 5.8: Questions within the AUDE survey clustered by theme (sub-scale)

ADA 2010

In this instance three broad classifications of factor were noted to display correlation with overall satisfaction. These were safety and security, which showed a strong positive correlation at the $p<0.01$ level, air quality(satisfaction factors), with a low positive correlation at the $p<0.05$ level and noise (bipolar factors) again displaying a low positive correlation at the $p<0.05$ level. (Appendix 6, table 78)

ADA 2012

In this instance four broad classifications of factor were noted to display correlation with overall satisfaction. These were safety and security, air quality (satisfaction factors), heat (bipolar factors) and noise (bipolar factors) all displaying strong positive correlation at the $p<0.01$ level. (Appendix 6, table 79)

TRB 2010

The application of the survey conducted in TRB in 2010 showed results that indicated no significant correlations between overall satisfaction and the themed cluster of factors that were measured by the survey questionnaire. (Appendix 6, table 80)

TRB 2013

The application of the survey conducted in TRB in 2013 also showed results that indicated no significant correlations between overall satisfaction and grouped factors that were measured by the survey questionnaire, with the exception of the theme of safety and security, which showed a positive strong correlation at the $p<0.01$ level.. (Appendix 6, table 81)

The analysis was repeated with the sub-scales for satisfaction and bi-polar satisfaction combined to allow an amalgamated analysis to be effected. The results of these analyses are set out in tables 82 to 85 of accompanying Appendix 6.

The results of this analysis showed that there are no themed factor groups that consistently show correlation with overall satisfaction. However, the theme associated with safety and security showed strong positive correlation with overall satisfaction in three of the four instance.

The conclusions arising from the quantitative analysis are discussed in a later chapter, along with the results of the qualitative analysis

Summary of Quantitative Analysis

Table 5.9 below summarises the identification of correlations between individual questions from the AUDE survey and overall satisfaction as expressed through responses to question 8. With the exception of questions 7b and 7c there are no questions or themes that show consistent relationship with the users perceptions of overall satisfaction

	Question	Correlates with Q8: Overall satisfaction ?			
		ADA 2010	ADA 2012	TRB 2010	TRB 2013
Section 1	1: Gender	✗	✗	✗	✗
	2: Occupation	✗	✗	✗	✗
	3: How long do you spend in the building during the day?	✗	✗	✗	✗
	4: How long do you spend working at a computer?	✗	✗	✗	✗
Section 2	5: Location	✗	✗	✗	✗
	6: If you spend any time in any other location type please highlight				
	7: Please rate the quality of the following areas				
	7a: Office	✓	✓	✗	✓
	7b: Lecture Room	✓	✓	✓	✓
	7c:Laboratory	✓	✓	✓	✓
S 3	8: How satisfied are you, in overall terms, with the building as a place of work (or study)?				
Section 4; Building Overall	9: Personal Safety: How safe do your feel in the building?	✓	✓	✗	✓
	10: Security: What aspects of the environment contribute to feeling safe?	✗	✗	✗	✗
	10.a. Visibility of security personnel	✗	✗	✗	✗
	10.b. Access control to the building	✗	✗	✗	✗
	10.c. Security zoning (access control to parts of the building)	✗	✗	✗	✗
	10.d. Lighting	✗	✗	✓	✗
	10.e. Spatial configuration (i.e. relatively large uncluttered spaces)	✗	✗	✗	✗
	11: How accessible is the building from the street?	✗	✗	✗	✗
	12: How easy is vertical circulation?	✓	✗	✗	✗
	13: How easy is horizontal circulation?	✗	✗	✗	✓
	14: How clean is the building?	✓	✓	✗	✗
Section 5 ; Communal Areas	15: Is the air fresh or stale?	✗	✗	✗	✗
	16: Is the air humid or dry?	✗	✗	✗	✗
	17: Does the air smell?	✗	✗	✗	✗
	18: Is the temperature in winter too cold or too warm?	✗	✓	✗	✗
	19: Is the temperature in summer too cold or too warm?	✗	✗	✗	✗
	20: Is this area of the building too noisy or too quiet for your liking?	✓	✓	✗	✗
	21: Is this area of the building well lit?	✗	✗	✗	✗
	22: Is there too much or too little natural light?	✗	✗	✗	✗
	23: Is there too much or too little artificial light?	✗	✗	✗	✗

	24: Please provide any comments about the communal areas of this building.				
Section 6; Primary work area	*25: Please select work area type*	✗	✗	✗	✗
	26: Does the quality of the air in this part of the building have a negative effect on your work performance?	✗	✓	✗	✓
	27: Is the air fresh or stale?	✓	✗	✗	✗
	28: Is the air humid or dry?	✗	✗	✗	✓
	29: Does the air smell?	✗	✗	✗	✗
	30: Is there air movement?	✗	✗	✗	✗
	31: Do you have control over ventilation?		✓	✗	✗
	32: Does the temperature in this part of the building have a negative effect on your work performance?	✗	✓	✗	✓
	33: Is the temperature in winter too cold or too warm?	✗	✗	✗	✗
	34: Is the temperature in summer too cold or too warm?	✗	✗	✗	✗
	35: Do you have control over heating?	✗	✗	✗	✓
	36: Does the distraction from noise in this part of the building have a negative effect on your work performance?	✗	✗	✗	✗
	37: Is there significant distraction from noise outside the space?	✗	✗	✗	✗
	38: Is there significant distraction from background noise?	✗	✓	✗	✗
	39: Does the quality of light in this part of the building have a negative effect on your work performance?	✓	✗	✗	✓
	40: Is there too much or too little natural light?	✗	✗	✗	✗
	41: Is there too much glare from the sun / natural light?	✗	✗	✗	✗
	42: Is there too much or too little artificial light?	✗	✗	✗	✗
	43: Is there too much glare from artificial light?	✓	✗	✗	✓
	44: Are the blinds / shutters / curtains effective in blocking out natural light?	✗	✗	✗	✗
	45: Do you have control over artificial lighting?	✗	✓	✗	✗
	46: Is the electronic data projection equipment effective?	✗	✗	✗	✗
	47: If you have any comments about your primary work area, please feel free to provide them in the space below.				
	71: If you have any additional comments that you would like to make about any aspect of your work environment please note them here.				
Themes					
Safety/security		✓	✓	✗	✓
Light/lighting		✗	✗	✗	✗
Accessibility/movement		✗	✓	✗	✗
Air quality		✗	✗	✗	✗
Heat/ventilation		✗	✗	✗	✗
Noise		✗	✗	✗	✗

Table 5.9: Summary of correlations between individual factors and satisfaction

5.3.2 Qualitative components of the research

In addition to the quantitative elements of the research there were several qualitative components of data collection. The qualitative elements of the main phase of the work included the free text questions that are contained within the AUDE questionnaire, together with a series of focus groups with representative groups of building users and semi-structured interviews with a selected sample Directors of Estates. Each of these components was designed to address specific questions within the research and they combine form the main part of the qualitative aspect of the work. The data gathered from these components are described and analysed in the following sections and are discussed alongside the quantitative components of the work in the following chapter.

These qualitative elements have been described in the context of the overall research design in an earlier chapter of this thesis. These elements of the work set out to address the a series of research questions in the context of Higher Education institution in England. The first two elements of the qualitative analysis were directed at the following questions:

- *to what extent does the data that is collected regarding user satisfaction align with users perceptions of the characteristics that actually affect satisfaction?*
- *to what extent do quantitative tools capture meaningful data that allows assessment of user satisfaction?*
- *is there a connection or linkage between certain factors and overall satisfaction?*

The third qualitative element was aimed at addressing the following research questions:

- *how is the qualitative and quantitative data analysed and used?*
- *what do those applying POE consider its purpose to be?*
- *to what extent do the outcomes of the POE process match the expectations of those applying it?*

Initial approach to computer aided data analysis

The data gathered from the qualitative elements of the research was initially subjected to analysis using the semantic analysis package 'Leximancer'. The software is intended to be used to analyse and categorise qualitative data based on a staged system of evaluation. The software has been applied in other contexts and although a limited amount of literature exists that relates to externally validating the software there is a body of work that relates to its application. Penn-Edwards (2010) compared how well Leximancer would identify categories whilst conducting phenomenographic analysis, comparing it with the traditional method of analysing it manually. He found that the categories which emerged from manual and Leximancer analysis were fairly close, therefore endorsing the use of it in the initial stages of phenomenographic analysis.

Smith (2000, 2003), who is the creator of Leximancer outlined that a different algorithm is used for each stage of the investigation. These included:

- *ranking algorithm-used to find seed, or concept*
- *machine learning algorithm- used to find relevant thesaurus words from the text data*
- asymmetric scaling algorithm- where data is made into a lattice by ranking concepts by their connectedness and centrality.

Algorithms are used to automatically select important terms, which are known as concept seeds. The software has the ability to learn a thesaurus of words for each concept seed which is cited as an improvement on existing technology.

The machine learning algorithm is a modified version of one from Computational Linguistics which has originally been used for word sense disambiguation. Another field Leximancer relies upon is physics to cluster concepts together by using physical force laws and numerical methods (Leximancer).

The outputs of the Leximancer seeds analysis produced a series of visible concept maps, together with a schedule of connectivity of key words and numbers of 'hits' within the sources of data. An example of the visible concept map, based on the data from the

ADA 2010 survey, is shown below in figure 5.6. This 'map' illustrates frequency/weighting of individual words or phrases together with linkages and relationships between words or concepts drawn from the text analysis. The key word connectivity schedule and 'hits' count are also illustrated in figure 5.7 and table 5.10 below.

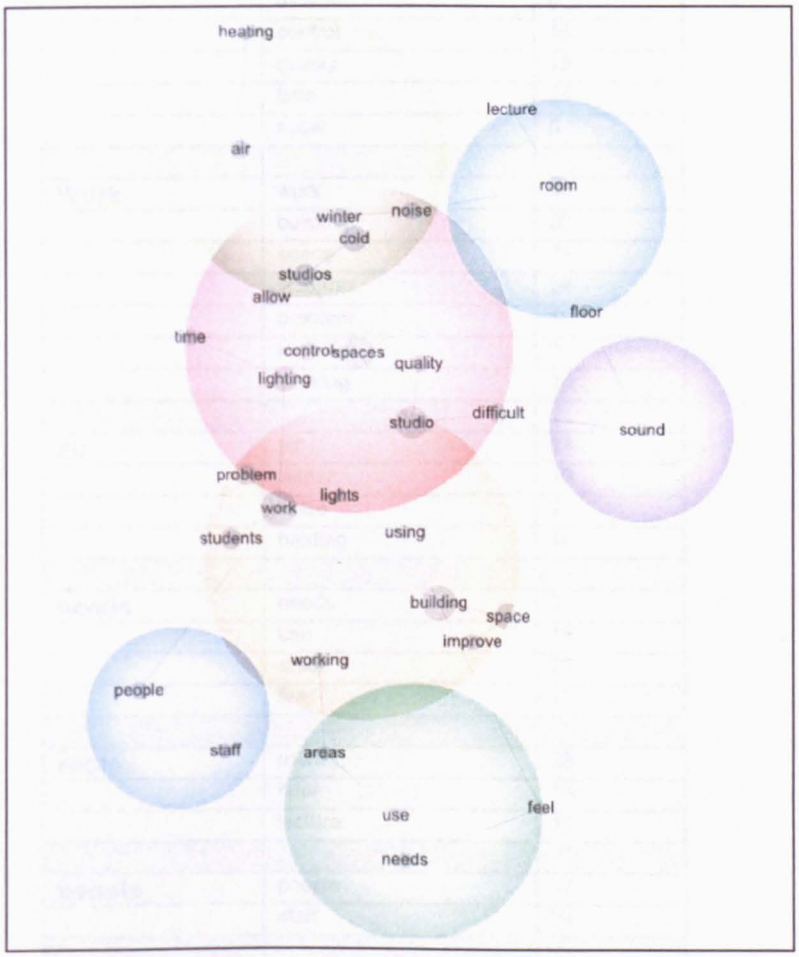

Figure 5.6: ADA 2010 Visible concepts map

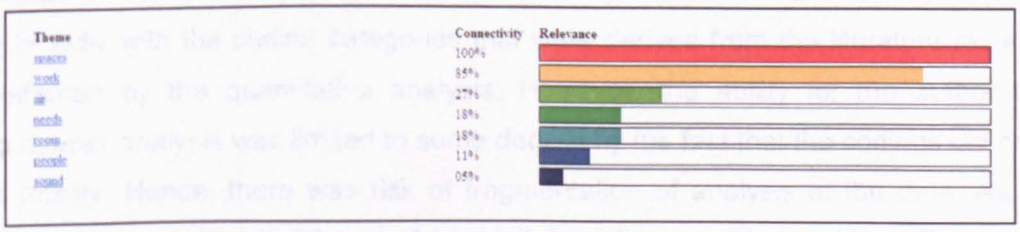

Figure 5.7: ADA 2010 Key word Connectivity Schedule

THEME:	Key Word	Hits
Spaces	spaces	18
	studio	24
	lighting	15
	cold	22
	studios	13
	difficult	0
	control	15
	quality	15
	time	24
	allow	0
Work	work	36
	building	62
	space	31
	students	24
	problem	10
	improve	0
	working	14
air	air	14
	winter	10
	noise	9
	heating	14
needs	needs	0
	use	16
	areas	23
	feel	12
room	room	28
	floor	16
	lecture	15
people	people	17
	staff	24
sound	sound	0

Table 5.10: Key words hit counts ADA 2010

The outputs of the Leximancer processing were informative and the concept seeds aligned broadly with the coding categories that were derived from the literature review and reinforced by the quantitative analysis. However, the ability for the author to develop deeper analysis was limited to some degree by the fact that the codings did not align in totality. Hence, there was risk of fragmentation of analysis of the data. As a result the author took the decision not to exploit the full capabilities and benefits of the

software and instead adopted the use of the established NVIVO (version 10) qualitative analysis package. Hence, the data were coded and reviewed using NVIVO to appropriate nodes depending upon the context of the data. Within this part of the work there were three discrete components of qualitative data; free text comments from the AUDE questionnaire, focus groups with building users and interviews with Directors of Estates. Each of these was directed at a different research aspect and they were coded appropriately to the specific research questions to which they related. The approach to coding drew on established principles and applied concept driven coding based on themes identified in the earlier stages of the work.

Free text questions from AUDE Questionnaire

The free text comments that were included within the AUDE questionnaire were considered within the research in the context of identifying key themes or factors that impact upon user satisfaction with the subject buildings. The responses were analysed to gain understanding of the factors that were, in the perceptions of the survey respondents, relevant to their overall satisfaction with the building or specific areas within it.

As described in the previous chapter the AUDE questionnaire includes 71 Questions with several of these repeated to allow application to different areas within the building. There are four key questions that allow respondents to provide qualitative commentary, which relate to defined sub-sections of the questionnaire. These are included within the various sections of the questionnaire as follows:

Question 24: is a free text question, included within section 5 of the questionnaire, which deals with factors relating to 'Communal Areas'. It provides the opportunity for respondents to give additional commentary on the issues contained within questions 15 – 23 which relate, largely, to perceptions of satisfaction with specific elements relating to communal areas of the building

Question 47: is a free text question within section 6 that provides the opportunity for respondents to give commentary on the issues contained within questions 25 – 46 of

the questionnaire relating to satisfaction with specific elements relating to their primary work area within the building

Question 70: is a free text question within section 7 that provides the opportunity for respondents to give commentary on the issues contained within questions 48 – 69 relating to satisfaction with specific elements regarding their secondary work area within the building

Question 71: is a free text question within section 8 that provides the opportunity for respondents to give commentary on the issues that may not be defined elsewhere within the questionnaire

The nature of the questionnaire and the facility for respondents to provide textual comments was such that, by their nature, the comments tended to be relatively brief and directly targeted at specific factors. They could also be placed, readily, in proximity to the quantitative questions to which they related. Hence, the results could easily be classified as relating to communal areas, primary work areas and secondary work areas. The comments made within question 71 related to potentially far wider scope and as such were considered as being more generic in their relevance.

As was the case with the earlier, quantitative elements of the data analysis, the responses for each of the free text questions were considered for each of the four instances of the application of the survey.

As part of the process to identify suitable node classifications or labels the 'word frequency search' feature of NVIVO was used to generate a report that identified the most commonly used words within the text. These were then cross referenced to the outcomes of the earlier literature review and quantitative analysis to ensure that there would be the ability to triangulate data across compatible themes or classifications. Glaser (1978) and Charmaz (1995) identify a two-step coding process in data analysis; open, or substantive coding and theoretical coding. Theoretical coding conceptualises how the substantive codes may relate to each other as a hypothesis to be integrated into a theory. Open (substantive) coding refers to the process of generating initial concepts from data, whilst axial coding refers to the development and linking of

concepts into conceptual families and the formalising of these relationships into theoretical frameworks (Strauss & Corbin, 1990; 1998).

Open coding and axial coding such as might be adopted in a grounded theory approach were not utilised in this instance as the nature of the data, its exploration and analysis linked to a pre-existing framework relating to satisfaction factors derived from the earlier literature review and quantitative analysis. As a result a concept-driven approach was taken to the coding process as advocated by Ritchie et al (2003) and King (1998) both of which are cited by Gibbs (2007). The codes were identified, initially with reference to the themes drawn from the literature review and the quantitative work. They were supplemented and refined on the basis of the word frequency search undertaken using NVIVO and were further developed as the process of coding was carried out as additional themes arose from consideration of the text. A summary of the coding references used and the frequency of instances of each is illustrated in table 5.11.

Approach to Analysis

Coding references:

	Art & Design Academy								**Tom Reilly Building**								**Total**
	2010				**2012**				**2010**				**2013**				
Question	**71**	**24**	**47**	**70**	**71**	**24**	**47**	**70**	**71**	**24**	**47**	**70**	**71**	**24**	**47**	**70**	
Air Quality	0	0	0	0	0	0	1	0	0	0	2	1	1	1	0	1	**7**
Heat	4	5	7	1	4	5	6	2	3	4	5	2	0	2	3	3	**56**
Light	2	2	3	3	2	2	4	1	1	3	9	3	1	3	3	3	**45**
Sound	5	4	3	0	1	1	1	1	6	2	2	0	0	1	2	3	**32**
Quality	0	1	0	0	4	0	0	1	2	0	2	0	8	7	0	1	**26**
FF&E	5	1	2	3	2	0	1	0	2	2	4	1	0	2	0	2	**27**
Ownership/ Familiarity	2	1	1	3	1	0	0	1	2	3	0	3	6	9	2	3	**37**
Space & Form	3	1	0	3	2	3	1	1	1	13	0	0	0	8	2	1	**39**
Building Management	8	3	2	5	5	5	3	1	5	3	3	0	5	5	2	0	**55**
Security	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**

Table 5.11: Coding frequency for the AUDE comments from questionnaires

Description and Interpretation

Air Quality

Comments relating, directly, to the broad theme of air quality featured only seven times across all of the applications of the survey, appearing only once in connection with the ADA. However, issues that could be deemed to be associated with air quality were also featured within wider ranging comments relating to heat and building management.

The areas associated with this theme varied between the two subject buildings in that the issues associated with the ADA were reflections on building management and operation, whilst those in the TRB were related directly with the wider issues of heating and ventilation.

Within the ADA there were isolated comments relating to smells generated from waste bins and from cooking in the TATE café being impactful upon the users' perceptions of the building and its quality of management. However, the comments were not made repeatedly and could not be considered to reflect any critical mass of commentary from users.

Within the TRB the comments were more common and they were generally aligned with comments relating to the themes of heat, quality and Fixtures, Fittings and Equipment (FF&E). The common thread for all of the comments made that could be coded as 'air quality' related to the provision of appropriate natural ventilation and the ability of users to effect personal control of this factor. In particular the provision of internal offices and other spaces within the building that lacked the provision of natural ventilation was the major issue and was identified in all of the free text responses that were coded to the theme of air quality.

The key factors that appear to influence users' satisfaction identified here were:

Presence of natural ventilation

Ability to control ventilation

Effective building management

Heat

The theme of 'heat' liberated the most number of comments within the free text responses, with 56 references across the various applications of the survey. This theme features in all instances of the survey and, with only one exception is referred to in all of the free text questions.

Although there were some key differences between the two subject buildings there were several common threads within the comments, which appeared in all of the instances of the survey and which featured in significant frequency to warrant note. The issue that featured most commonly and which was reflected in all instances of the survey was the perception that the users did not have the ability to effect thermal control of the environment in which they studies or worked. In addition the perception that the buildings were cold during winter was reflected in both buildings, with a clear commentary indicating that for, some users, this had a negative impact upon overall satisfaction. There were 23 comments relating to the ADA indicating that respondents perceived the space as too cold in winter, whilst the TRB liberated just 7 such comments. Commentary relating to the lack of ability of users to effect thermal control, or the general issue of lack of effective thermal control in the building occurred in 28 separate instances between the two buildings.

Users of both buildings also commented upon the presence of draughts creating discomfort. In the case of the ADA particularly, this was linked to the themes of quality and FF&E with numerous references to the poor fit and operation of the windows in that building.

The key factors that appear to influence users' satisfaction identified here were:

Temperature in winter
Users' ability to control temperature
Perceptions of quality of construction
Presence of draughts

Light

Light featured as a theme in all of the free text questions in all of the applications of the survey, with a total of 45 comments being identified with reference to light or lighting. A key theme in both of the subject buildings was the perception of dissatisfaction with lighting control. More than 20 comments cited the issue of inappropriate or poorly timed automated control of lighting, although these comments are, in part, reflected within the 'ownership and familiarity' theme.

The comments were also directed repeatedly at the issue of provision of natural light. This was a particular cause for concern within the TRB where 21 comments were noted regarding absence of natural lighting in office areas that are totally internal. This is reflected also within the 'space and form' theme. A broader issue, which was noted in both buildings, was associated with the general balance between natural lighting and artificial lighting within the buildings and within specific spaces. Several positive comments were noted relating to natural lighting in the studio and laboratory areas, whilst lighting within office areas was generally criticised for being too dim or gloomy.

There was a single, isolated comment relating to the presence of glare within the TRB teaching rooms, which was deemed to impact upon the ability to use projection facilities effectively. However, this comment was not cited repeatedly.

The key factors that appear to influence users' satisfaction identified here were:

Effectiveness of automated lighting control
Users' ability to effect local lighting control
Absence of natural light in key areas of the building
Quality of artificial lighting to offices
General balance between natural and artificial lighting

Sound

Sound (or noise) featured in 32 comments overall, with the majority (22) of the comments being made in the earlier applications of the survey in the case of both buildings. The comments relating to the first application of the survey within the ADA focused, strongly, on the issue of poor acoustic performance of individual spaces and the impact of this upon work and study. Interventions were made by the estates department to address some of these issues with retro-fitted acoustic panelling and the comments from the later survey were less critical of the issue. However, in both buildings there were numerous negative comments regarding the acoustic performance of rooms (17 in total) with 'hard' surfaces and the occurrence of noise transfer between spaces (9 in total).

Some of the comments also cited the slamming of doors and the moving of furniture as reasons for the noise intrusion. Some of these factors were also noted within the theme of 'building management'. In the TRB there were 5 comments regarding the intrusion of noise from mechanical and electrical equipment. In general the issues of noise disturbance and poor acoustic performance of spaces were considered to be distracting and impactful upon the ability to study or work with the required degree of concentration. Hence, there was a suggestion that this factor is significant in users' overall perception of satisfaction.

The key factors that appear to influence users' satisfaction identified here were:

Acoustic behaviour of teaching spaces
Noise intrusion from adjacent spaces
Noise disturbance from building operation and use

Quality

Comments associated with the broad theme of 'quality' featured strongly in connection with the TRB. 26 comments were made in total, of which 20 were associated with the TRB. The comments made in relation to both buildings referred to broadly similar factors, which included overall quality of the finished building and quality of fixture and fittings (some of which were replicated within the FF&E theme). In both buildings, but with particular frequency in the TRB, comments were made relating to the harshness of

the finished building interiors, including the industrial feel of the design approach. The presence of unfinished concrete surfaces was cited in both buildings as a factor that induced negative perceptions regarding overall quality and satisfaction amongst users. Several of the negative comments were based upon perceptions of 'overall feel' rather than specific items or features although there was a clear pattern of commentary that reflected this and indicated a linkage with perceptions of overall satisfaction. The quality of décor and workmanship/detailing were also noted within these comments to be of importance to the respondents' overall perceptions of satisfaction.

Although featuring, to some extent, within the FF&E theme, there were also several comments within this theme relating to the quality and durability of fixtures, fittings and components such as windows and door furniture. These elements were considered to be indicative of overall quality of the building.

The key factors that appear to influence users' satisfaction identified here were:

Quality of décor and finishes
Quality of detailing and workmanship
Quality and durability of fittings and components
Overall feeling of austerity in design approach

FF&E

Fixtures, fittings and equipment (FF&E) were commented upon 27 times overall with a relatively even distribution between buildings. However, there was a notable difference in the number of responses between the dates of survey application, with 20 of the responses being generated in connection with the earlier surveys.

The comments made in connection with the two subject buildings differed in their specific focus. However, the principles underlying the comments showed a degree of consistency in terms of the perceived impact of the issues upon overall satisfaction. In most cases the issues that were raised were irritants to the occupiers rather than major inhibitors of functionality. In the TRB there were two main areas of concern. Firstly, there was the issue of design detailing and installation of FF&E within the toilet areas, which was related to positioning of fixture and fittings. Secondly there was the issue of

quality of fixtures and fittings and their premature failure or degradation; this focused in particular upon door furniture.

The key factors that appear to influence users' satisfaction identified here were:

Ownership/ Familiarity

There were 37 comments in total relating to this theme, 30 of which were made in the context of the TRB. The pattern of comments in this theme was notable with 20 of the responses being concentrated on the second application of the survey within the TRB. The principles of 'ownership' or 'control' featured in several discrete code or nodes during the qualitative analysis and there was a considerable degree of repetition in the comments made. The free text comments that have been coded to themes such as heat, light and space/form are, to some extent, replicated within this theme.

The major factor that was featured within this theme related to ownership or identification of space. The issue of communal space with the perception of ownership or 'sense of place' featured in more than 30 instances across the two subject buildings and was a factor that was referred to in all instances of the survey. The concept of identity was also introduced within this thematic area with comments relating to the demonstration of departmental and cohort identity featuring in both of the subject buildings. The most common and consistent issue noted within this thee was that of the absence of identifiable social space and communal space allocated to the congregation of staff and students within separate groupings. Both staff and student groups identified the need for segregated space as a factor in their perceptions of overall satisfaction.

A further element within the theme of ownership and familiarity that was a particular feature of the TRB was the clarity of way finding signage and the absence of a physical reception facility that could assist with directing non-familiar users of the building to their intended destination.

Although reflected in separate themes within the overall analysis there were several comments relating to the ability of users to effect control of environmental factors such as heating, lighting and ventilation that were reflected in the theme of ownership and

familiarity as the comments made were in part related to IEQ and in part related to the ability to effect ownership or control of a factor or group of factors.

The key factors that appear to influence users' satisfaction identified here were:

Provision of identifiable spaces that are 'owned' by discrete user groups
Way finding signage and directional facilities
Visible identity and ownership of spaces to support group identity
Ownership or control of IEQ factors

Space & Form

Of the 39 comments made relating to this theme, 27 related to the TRB and in particular there was a concentration in the first application of the survey associated with communal areas within the building. This question liberated 13 responses in its own right. There are strong linkages between this theme and that of 'ownership and familiarity' and much of the commentary relating to communal areas is reflected under that theme. The comments coded under this theme related to absence of appropriate or sufficient storage and in particular the absence of appropriate spaces for the congregation of staff and students, including welfare facilities. This was one of the main factors that featured in several thematic groupings and which was consistent across all iterations of the survey application. The TRB, in particular, was subject to commentary regarding the ability to navigate through the building and the absence of a focal point at building entry, such as a reception or unmanned way finding station.

This theme also liberated several positive comments regarding the size and form of spaces such as studios and laboratories.

The key factors that appear to influence users' satisfaction identified here were:

Absence of identifiable community space for staff and students
Poor provision of storage space
Lack of generic display spaces
Difficulty in navigating through the building
Good quality spaces for studio and lab activities

Building Management

Building Management liberated the second highest number of comments with 55 in total. Many of the comments received related to operational issues such as maintenance of components and these reflected comments made within other themes relating to poor durability of door furniture, windows and so on. There was a consistent theme in both buildings relating to doors, slamming, operation of windows, reliability of items such as automated controls etc that could be considered, broadly, as building maintenance issues.

In addition, the operation of activities, such as the café space within ADA, were noted to impact upon teaching and work activities negatively, due to noise intrusion. Similarly smells from cooking and over-filling of bins were cited as environmental intrusions due to odours.

Cleaning was a consistent theme across all applications of the survey and the interior and exterior cleanliness of the buildings featured in 27 comments. This suggests that cleanliness is an important factor affecting users' overall satisfaction with the building.

The key factors that appear to influence users' satisfaction identified here were:

Cleanliness of the interior and exterior
Management of activities generating noise within the building
Effective maintenance of components and systems

Security

The issue of security liberated only a single comment, suggesting that the issues surrounding security and safety are not a cause for concern to the building occupiers. The comment that was submitted related to the ADA. This was a bland statement as follows:

'*Security needs to be better*'

Focus Groups with building users

A series of focus group sessions was conducted with users from each of the buildings to gather information regarding their perceptions of satisfaction with the building and with specific factors that they considered to be significant. Four focus group sessions were conducted with two sessions relating to each of the subject buildings, one for staff and one for students. The groups comprised between 6 and 9 participants and each session was conducted by an independent moderator rather than the author. This approach was taken to ensure the absence of any potential bias in questioning or the possibility of inadvertently leading or directing the discussion.

All of the sessions were recorded and subsequently transcribed to facilitate analysis. However, due to the potential for confusion in transcription arising from the conversational nature of the session, with multiple voices contributing, the sessions were also supported by a note taker to minute key aspects of the discussion. These two mechanisms facilitated, as far as possible, accurate and contemporaneous record keeping of the sessions.

- *Do you have discernible feelings of satisfaction or dissatisfaction associated with the building in which you work or study?*
- *If so, what are the factors that affect your feelings about the building?*
- *What features or characteristics of the building and your interaction with it affect your overall satisfaction?*
- *Are there factors that are not linked to the physical building environment that impact upon your overall satisfaction with the building?*

The transcripts were used as the primary source of data, with the supporting notes being utilised where there was potential for confusion or uncertainty in the transcription process. In order to structure the content of the focus group transcripts in such a way as to allow meaningful analysis they were entered in to a computer aided qualitative analysis programme in the form of NVIVO (version 10). The content of each of the transcripts was then coded to a hierarchical structure of nodes that reflected the content of the transcripts and the framework derived from the literature review and the quantitative analysis that has previously been described.

	Art & Design Academy		Tom Reilly Building		Total
	Staff	Students	Staff	Students	
Air Quality	0	0	1	0	**1**
Heat	4	5	3	6	**18**
Light	3	3	5	4	**15**
Sound	4	1	4	7	**16**
Quality	8	9	11	9	**37**
FF&E	2	2	3	2	**9**
Ownership/ Familiarity	7	2	8	10	**27**
Space & Form	13	8	4	9	**34**
Security	1	1	0	0	**2**
Building Management	10	5	1	2	**18**

Table 5.12: Focus Group coding summary

Description and Interpretation

Air Quality

There were no specific references to air quality during the focus group sessions, other than a single comment relating to the TRB which referred to an office area being cramped and 'smelly'. This appeared to be a very localised issue associated with how the space was used rather than the overall environment of the building. However, there were several comments relating to ventilation and, in particular, the ability to effect local ventilation through opening windows. These are considered under the thematic headings of heat and FF&E

The key factor that appears to influence users' satisfaction identified here was:

Local control of ventilation

Heat

The issue of heat was raised in all of the focus group sessions to some extent. There were two strong, recurrent themes associated with this factor.

Firstly the issue of extreme variability of temperature within parts of the buildings depending upon time of year and time of day. The primary concern was associated with solar gain and the impact upon parts of the buildings in terms of localised, increased temperatures. Although some concerns were also expressed relating to extremes of cold in parts of the buildings there was far less discussion on this point, with the main issue affecting satisfaction being cited as extremes of high temperature. This issue afflicted both buildings to a similar extent and was considered to be a significant factor affecting overall user satisfaction and the ability of building users to undertake work and study comfortably.

Secondly, the issue of control and controllability of the thermal environment was cited as an issue in all of the focus groups. The inability to effect local control of temperature was a factor that was linked to overall satisfaction, although it was not, in all cases, associated directly with comments regarding thermal discomfort. The issue of control appears, in part to be abstract from feelings of thermal discomfort and even where contributors to the focus groups noted that they were comfortable with temperatures, there was still an element of concern regarding the ability to effect control. There was a further element relating to control of the heating and ventilation systems that was focused on the effectiveness and responsiveness of the buildings' thermostatic control systems. All of the focus groups noted this as a factor affecting users' satisfaction and the same theme was present in all discussions; that being the inability to achieve consistent, comfortable temperatures within air-conditioned spaces. There was a view, expressed repeatedly, that temperature control in these spaces was lacking in appropriate sensitivity, resulting the general perception that temperatures would routinely be too hot or too cold, with the control system operating to generate extremes rather than consistent comfortable temperatures.

Some examples of comments extracted from the focus groups are as follows:

> *'The Main auditorium is terrible it seems to have no thermostatic control' (ADA)*
> *'Solar gain is a problem in some areas mostly the offices'(ADA)*
> *'High temperatures and lack of controllability of heating and ventilation make working really difficult in some places'.(TRB)*

The key factors that appear to influence users' satisfaction identified here were:

Local control of heating and ventilation
Effectiveness and sensitivity of thermal control installations
Seasonal and diurnal temperature variation in local areas
Management of solar gain

Light

Light and lighting featured as a factor in all of the focus groups. In the TRB particularly, there was a strong view that access to natural light and ability to see out of the building were major issues affecting user satisfaction. Two broad themes were reflected in the discussions surrounding this. Firstly there was a strong view expressed by both staff and students that the use of fully internal rooms, which had no access to natural light or natural ventilation had a significant negative effect upon user satisfaction. This issue afflicted offices and meeting rooms most significantly and it was considered as a major factor in the utility and enjoyment of the building. A linked issue to this was the presence of coloured, translucent or opaque glazing, which was generally considered to be a hindrance to satisfaction. The staff and student groups associated with the TRB both cited the inability to see out of the building in certain spaces as a negative factor in their overall perception of satisfaction with the building.

The focus groups liberated several positive comments relating to lighting in respect of the ADA, although there was a degree of variability between the staff and student groups. Generally the students' perceptions were strongly positive, indicating that the teaching and studio spaces were well lit and provided good quality space for their work and study. This was considered impactful on their overall perception of satisfaction with the building. Similar views were expressed by staff. However, the degree to which offices were considered to provide adequate lighting, through natural or artificial means, was far more limited. The use of areas without sufficient access to external views and natural light was cited several times as a factor that affected, negatively, overall perceptions of satisfaction.

There were also comments relating to the occurrence of glare in some areas where visual display was compromised as a result. Whilst the focus groups identified that this was an issue that had impact upon overall satisfaction, they did not identify this as a major factor affecting the subject buildings.

Comments made during the discussions include:

> *'Dark ceilings make the space feel really gloomy'(ADA)*
> *'Offices without windows and natural light are real cause of dissatisfaction and negative perception'(TRB)*
> *'Translucent glazing is very unpopular due to inability to see out. People feel depressed.'(TRB)*
> *'Glare from windows in classrooms makes AV difficult especially with coloured glazing panels. The lighting is really weird.'(TRB)*

The key factors that appear to influence users' satisfaction identified here were:

Access to natural light and external views
Quality of artificial lighting
Lighting quality in smaller rooms and offices

Sound

All of the focus groups identified acoustic factors as being significant to overall perceptions of satisfaction with the buildings. The broad themes that were noted as being impactful were similar in both buildings and between both staff and student groupings. These fell in to three distinct categories of concern. Firstly, the issue of background noise from building services was noted; this was particularly the case with the TRB, although it was also noted in connection with the ADA. Secondly there was the issue of noise transfer or cross-over between spaces. Noise from corridors was noted to affect the users of classrooms and offices. In addition there was a strong perception that noise insulation between spaces was poor in both buildings and this linked with the theme of ownership and familiarity as one of the major points of concern was associated with intrusion into privacy. It is recognised that this factor is partly about

privacy of space and perceptions of ownership and is partly about acoustic performance of the building. Thirdly, the overall acoustic performance of the building and the interior spaces was noted as a factor affecting satisfaction in both buildings. The acoustic behaviour of both buildings was subject to the comment that hard surfaces and an industrial design style contributed to echo and poor acoustics in common areas and teaching spaces. This was particularly noted in the case of the TRB where exposed building services and the absence of suspended ceilings were also cited as a contributing factor This area is also featured in the discussions regarding the theme of quality.

Examples of comments made include:

'Noise from corridors disturbs classes all the time'(ADA)
'Hard surfaces around the place are really bad in terms of acoustics'(ADA)
'Retro fit acoustic management was put in and works well – but it was cost engineered out of the original building'(ADA)
'The main lecture theatre is difficult to teach in the acoustics are really poor'(ADA)
'Echo problems from all of the bare walls result in high internal noise levels'(TRB)
'Internal corridor doors operate in a really noisy way. They are a constant irritant'(TRB)
There is persistent noise from internal services installations in offices and teaching spaces and really excessive noise from plant and equipment.'(TRB)

The key factors that appear to influence users' satisfaction identified here were:

Intrusive background noise
Noise transfer between spaces
Perceptions of lack of privacy in some spaces
Acoustic behaviour of large spaces and classrooms

Quality

The theme of quality featured within the earlier AUDE survey questionnaire, but without any definition of what was intended to be meaning of the term. Within the focus group sessions this was explored more fully and it appeared the term was generally perceived to relate to fitness for purpose, durability and robustness. In addition there was a broader linkage to perceptions of design quality, attention to detail and décor. The author did not present focus group participants with a fixed definition of the term but,

rather, allowed the discussions to evolve freely around the theme. The resulting comments provided a degree of insight in to the participants' understanding of the term as well as their views on the impact of the theme upon overall satisfaction. One of the concerns noted by the author with regard to this theme was the potential for it to become a duplication of the 'overall satisfaction' construct. However, this did not appear to be the case.

This theme was subject to comments in all of the focus groups and liberated more comments than any other theme. It was also subject to some of the most strongly voiced commentary. The participants' discussions suggested that this was one of the key factors affecting overall satisfaction, despite the absence of a tight definition of the meaning of the term. The focus of discussions was consistent between the two buildings with considerable commentary and criticism of finishing and detailing quality. The level to which the buildings were both perceived to display elements of 'shoddy' workmanship or unfinished details was voiced most strongly in relation to the TRB but was largely consistent between the two buildings. The factors that were discussed within this overall theme were, to some extent, reflections of issues discussed in relation to other themes. For example, there was considerable discussion in relation to the quality and durability of windows in the ADA. This was also reflected within the theme of 'heat' in the context of the inability to effect natural ventilation control due to poorly fitting windows.

In both buildings the impact of poor finishing quality and the perceived absence of careful detailing was cited as a major contributing factor to perceptions of overall satisfaction. It was also noted that the subjective views associated with design style featured strongly within discussions about quality. There was an element of discussion relating to the industrial design style of the buildings, which was considered to be an issue of quality by a minority of participants. This was voiced, very strongly, by some members of staff in the TRB. However, the underlying issues were raised more consistently by all users across both buildings; those being positioning of fixtures and equipment, quality of finishing and quality of detailing. In some areas of the buildings it was considered that installation of fixtures and equipment was poorly considered. Examples of this include; the installation of urinals in a very low position and the installation of hand dryers in a very high position within the toilet areas; the positioning

of poorly located computer installations in classrooms as an 'afterthought' and the installation of security 'swipe access' panels that allow building users to be stranded within internal stairwells.

There was also a view expressed that linked perceptions of quality with organisational brand image. This was considered to be an important factor on the part of both staff and students and one which had both positive and negative impact upon perceptions of overall satisfaction. In the case of the ADA there was a body of opinion that suggested that the perception on the part of building users that they were studying and working in a high quality building gave a strong sense of place and pride in the organisation. Similarly, this was expressed in the specific case of laboratory users in the TRB. However, the wider user group in the TRB voiced a contrasting view, indicating that the 'shoddy' elements of quality impacted negatively upon users' perceptions of overall quality, sense of place and institutional brand.

Examples of comments made include:

'Fit & Finish is rubbish – windows just don't shut'(ADA)
'Floor boxes are way too flimsy, they are constantly broken'(ADA)
'the quality of the main lecture theatre is poor –they have chosen a noisy, rickety system for seating' (ADA)
'The building has poor quality feel internally'(TRB)
'The poor level of finish and fi detracts from the overall building.'(TRB)
'There is really poor internal detailing and shoddy finishing'(TRB)
'The interior has feeling of being unfinished and fixtures and fittings are of poor quality and suffer from low durability.'(TRB)
'failure of internal fittings, door seals, stops and ironmongery is really common.'(TRB)
'Trims and fixtures are failing and falling off all the time'(ADA)
Dusting from unsealed concrete surfaces make the place constantly dirty and the external rendering failures are unsightly'(TRB)

The key factors that appear to influence users' satisfaction identified here were:

Quality of fit, finish and décor
Institutional brand identity and sense of place
Detailing and design features
Durability of fixtures, fitting and components

Design style and linkage with brand

FF&E

Several of the factors noted within discussion related to the theme of fixtures, fittings and equipment also featured within other themes. Most notably the issues raised within this area also featured under the quality theme. There were two groupings of comments arising from the focus groups. Firstly there was discussion regarding the presence or otherwise of specific elements of FF&E. secondly, and more prominently, there was the issue of the durability and functionality of FF&E items and components.

The durability of fixtures and components was seen as a reflection upon the overall quality of the building and upon the robustness of the environment. Several comments were presented that suggested that in the perceptions of the building users poor quality fixtures, fittings and components were used as a mechanism for reducing construction cost. This viewpoint introduced a wider perception that the buildings had been procured and constructed as cheaply as possible and that they were, therefore, considered to be below an ideal standard of overall quality.

There were also suggestions that specific elements of ff&e were omitted from the building and that these impacted upon overall satisfaction. However, the discussions within the focus groups indicated that the items cited were disparate and were related to very localised issues and specific members of staff. As such they were not considered by the author to be key factors affecting overall satisfaction.

Examples of comments made include:

'There is no back projection in the lecture theatre, which is amazing in this day and age.'(ADA)
'The main lecture theatre seems poorly planned with no proper projector for external projects' (ADA)
'The sinks in WC areas are far too low, the high pressure taps splash water all over you and the hand dryers are too high.'(TRB)
'Positioning of AV in classrooms is really poorly considered. You have to have your back to the class.'(TRB)

The key factors that appear to influence users' satisfaction identified here were:

Durability and perceived quality of components
Positioning and integration of ff&e components

Ownership/ Familiarity

The focus groups for both buildings generated considerable discussion relating to the theme of ownership and familiarity. With the exception of the themes of 'quality' and 'space and form' this theme liberated most comments within the discussions. The broad issues that featured within this area focused on perceptions of ownership of spaces that supported identity, sense of place and collegiate activity. In addition there was a strong body of commentary relating to signage, way finding and general ease of circulation through the spaces.

Although featured within other themes, such as heat and light, the issue of local control of the environment featured heavily as part of this theme. There was a consensus that this was an aspect of 'ownership' and that it contributed to general perceptions of ownership and satisfaction. It was also noted within the discussions that the ability to support local control within large, multi-occupier, buildings was limited and that the centralisation of environmental controls was an essential feature of modern buildings. However, it was also noted that when this is ineffective or unsatisfactory it quickly becomes an issue that affects overall user satisfaction with the building as a whole.

All of the focus groups identified this theme as being significant to overall satisfaction and both staff and student groups cited the provision of identifiable social or community spaces as being important to development of a sense of identity, brand and coherence. In this context the ADA was subject to specific commentary regarding the division of ownership of space between corporate functions such as conferences and external events and what, was considered by departmental staff, the core business of learning and teaching. There was a distinct difference in the views of those in the ADA with those in TRB regarding signage, way finding and general navigation through the buildings. The absence of a visible 'welcome point' within the TRB was identified by

both staff and students as being a negative factor in overall perception of guests and regular users of the building.

The issue of sense of place was raised in all of the focus group sessions with differing levels of opinion regarding the extent to which it was achieved within the two subject buildings. In both buildings there was a strong view from both staff and students that the provision of defined, segregated, spaces that are 'owned' by staff and student groups is a key factor in perceptions of overall satisfaction.

Examples of comments made include:

> *'Public access is supposed to be encouraged but there is little capacity internally or externally in spaces.'(ADA)*
> *'Internal signage is poor and confusing'(TRB)*
> *'External signage is limited'(TRB)*
> *'Absence of social spaces for staff and students is the biggest issue' (TRB)*

The key factors that appear to influence users' satisfaction identified here were:

Provision of identifiable community spaces for staff, students and cohort groups
Effective signage and way finding
Provision of 'welcome points'
Ability to effect local control

Space & Form

The theme of space and form was, perhaps understandably, the area of most discussion and comment within the focus groups. All of the focus group participants considered that this theme was a key factor in the perception of overall satisfaction with the building. The comments that were generated from the focus group sessions were in some instances very specific to a particular space or user group. There were several recurrent issues associated with the configuration and allocation of spaces within the buildings. There was a significant cross over between this theme and the theme of 'ownership and familiarity' in the context of allocation of spaces to user groups and

functions. The issue of segregated staff and student spaces was raised by both staff and student participants.

The comments relating to spatial configuration were, to a large extent, parochial and specific to individuals or select user groups. However, there was a consistent element of the discussions that suggested that the space and form of the building are key factors affecting overall satisfaction with the building. A particular element of configuration that was cited in respect of the TRB was the circulation space and the extent to which navigation through the building should be intuitive. There is a linkage here with the comments that relate to familiarity and ownership, where the issues of signage and way finding were considered to be significant to satisfaction. Within the ADA there was a conflict between the concept of flexible, reconfigurable, space that was aimed at providing a flexible and multi-functional building and the users' aspirations for permanency and sense of place. It was noted that, in practice, the reconfiguration of spaces in real-time relies more on effective facilities management practice than upon physical building form. This was seen by both staff and students as a weakness in the spatial concept of the building.

The discussions also indicated that the factors of space and form did not impact upon user perception in abstract but were associated with pre-defined elements of the design brief or of users' expectations of what would be delivered in terms of space and form. The primary area that was identified as a positive or negative factor affecting user satisfaction was the extent to which the final manifestation of the building reflected the users' expectations of what would be delivered. Clearly this factor is represented most strongly by users to whom the building is new and who have a basis of comparison in a previous location.

Examples of comments made include:

> *'Poor building spaces generally and bad communication and display spaces'(ADA)*
> *'There is lots of open plan space but not very well focussed in large adaptable spaces that lack character'(ADA)*
> *'Space supply & demand isn't matched– we need smaller more specific spaces. There is limited adaptability in the bigger spaces which seem mis-matched with demand. Lighting and ventilation inhibits subdivision."(TRB)*

'There are well considered adjacencies and proximity of spaces and the physical layout works well for space linkages.'(TRB)

'Movement of people does not work well; circulation and flows are poorly planned'(ADA)

Open plan studios are popular with Fine Art students – and engagement and productivity is benefitted.'(ADA)

'Does the lecture theatre need to be so flexible? – the aspiration for using it as a Gallery/Lecture theatre is basically flawed.'(ADA)

The key factors that appear to influence users' satisfaction identified here were:

Matching users expectation s of space and form

Identifiable space for user group 'communities'

Provision of social or community space

Effective and intuitive circulation space and way finding

Security

The theme of security did not feature extensively in the focus group discussions for either building. Although the issues of circulation and accessibility were noted as impactful upon overall satisfaction the issue of security and safety was not cited as being of significance in terms of overall satisfaction. However, it should be stressed that the comments that were introduced within the focus groups on this issue were uniformly positive. As such the author is hesitant to conclude that security is not a significant factor in overall user satisfaction, since there was insufficient data relating to the factor to allow meaningful commentary within the focus group analysis.

This factor did not appear to influence users' overall satisfaction with the building.

Building Management

Building management was cited as a theme that had significant affect upon overall satisfaction in all of the focus groups. However, the individual issues raised were highly specific to user groups and areas of buildings. There was a divergence of perception

between staff and students, with the issue of cleaning and cleanliness being considered highly important by staff but less so by students. This divergence of view appears to be associated with the use patterns and perceptions of occupancy between the two groups. Students considered themselves to be intermittent or occasional users of the space and were users of numerous different spaces for relatively short periods of time. The staff, in contrast, identified strongly with a small number of areas that they considered as their base within the building; such as their own office, meeting rooms, laboratories etc. Staff were also far more concerned with the perceptions of other visitors to the building and cited the cleanliness of the common areas and public spaces as being a key factor in developing an overall perception of the building and the organisation. The issues of 'sense of place' and 'pride in place' were raised in strong connection with this theme.

The other consistent factor that was noted here was the effective and responsive provision of building maintenance. Both staff and student groups in both buildings noted the importance of maintaining the building and its components effectively as a key factor in overall satisfaction. The theme of 'quality' identified the importance of durability and robustness of components and this was reflected in building management also. All of the focus groups noted that minor maintenance issues, such as replacing lamps, fixing door furniture and addressing leaks and blockages in toilet areas, if left unattended had a major impact upon overall satisfaction.

A further element of building management that was noted as being important to users was the issue of spatial configuration within teaching and meeting rooms. The movement of furniture and the lack of consistent configuration were noted as being disruptive to the delivery of classes and meetings by both staff and students.

Examples of comments made include:

> *'Smoking around entrances should be controlled more and the state of the bin stores is a disgrace.'(ADA)*
> *'Different areas with different uses makes for conflict– conference and events booking study areas for conferences stops effective teaching.'(ADA)*
> *'We needed to retro-fit sub division of space for teaching due to conference events booking core teaching space'(ADA)*

'M&E un-commissioned – air con does not work in staff offices, this should be easy to fix.'(TRB)

'External glazing is routinely dirty and difficult to clean due to solar shades.'(TRB)

The key factors that appear to influence users' satisfaction identified here were:

Cleanliness

Building condition and maintenance

Condition of public spaces

Day to day facilities management

Furniture configuration

Interviews with Directors of Estates

A series of semi-structured interviews was conducted with Directors of Estates, or equivalents, from selected HEIs. These interviews were intended to gather information relating to the perceptions of those conducting the POE process regarding its purpose and its efficacy. In addition to considering the purpose and effectiveness of the POE process the interviews also included exploration of the factors that the Directors of Estates considered to be significant to building users in relation to overall satisfaction. The structure of the interview component of the qualitative research was based on the 7 stages that are typical of interview based qualitative research activity as follows:

1. Thematising: this involved the formulation of the basic hypothesis regarding the perceptions of efficacy of POE using quantitative models in Higher Education Institutions.

2. Designing; this involved the planning of interview components within the overall research structure and definition of the interview sample

3. Interviewing: the semi-structured interviews were based on 'guide' scripting to ensure that all of the main thematic elements were brought in to the discussion between the interviewer and the subject.

4. Transcribing: verbatim transcription of the interviews was undertaken to ensure complete capture of all of the potential information and opinion that could be liberated.

5. Analysing: the interview transcripts were subject to a process of categorisation and qualitative interpretation based on coding that was undertaken using the NVIVO programme

6. Verifying: reliability and validity checks were undertaken by having the analyses and interpretations presented by the author reviewed by an objective individual.

7. Reporting: the qualitative interview analysis was converted to readable output for incorporation into the final thesis.

(based on Kvale 2007)

The scope of these interviews was broader than the other quantitative and qualitative parts of the research. They included questions that were aimed at attempting to gather data on the interviewees' perceptions regarding significant factors that influence building users overall satisfaction. In addition, they also focused on Directors of Estates' views and opinions regarding the effectiveness and value of the POE process as well as gauging the level of their knowledge and views relating to the principles of application and the organisational purpose of POE. In order to ensure that the same key areas were featured within the interview discussion a loose framework for the interviews was established that drew from the knowledge and insight gained through the initial literature review and the pilot interviews that were conducted within the first phase of the research. Each of the interviews was conducted face to face and they lasted between 60 and 90 minutes. Prior to undertaking the interviews the author communicated with the interviewees by email and telephone to provide a briefing on the purpose and context of the interviews and to give a general overview of the research project. The interviews then took place in accordance with a pre-arranged schedule to ensure that sufficient time was made available to allow for the necessary duration of discussion.

The effective application of the interviews within this part of the work relied on an appropriate level of subject knowledge on the part of the author. The conceptual, theoretical and practical knowledge of the topic was developed from the author's own experiential knowledge and through the undertaking of a detailed literature review. The existing, published knowledge base associated with POE, its evolution and application is widespread and highly developed in key thematic areas. However, the effectiveness of the application of established models has been questioned by many commentators, (Steinke et al 2010). This work allowed the outcome to identify specific areas of investigation associated with the purpose of application and validity of POE models with Higher Education institutions in the UK. These areas provide the basis and the focus and subject of the interviews used in the study.

Determining the number of interviews

Eight interviews were conducted within this part of the study based on a selection of participants from a quadrant analysis which is explained in detail in the following sections. This number was considered appropriate as the Fisher test of significant differences between groups can be effected with samples as low as 3/3 at a probability level of $p < 0.05$ (Siegel, 1956).

Interview process/form

In order to ensure that the interviews for Stage 2 of the study were appropriately focused and adhered to the core themes or the knowledge enquiry a 'script' or template was used. This aimed to ensure consistency and focus. At the same time, the semi-structured form was intended to allow openness and the introduction of new concepts, and views. The interview questions were structured to ensure that there was a direct link to the research aims and research questions set out at the commencement of the study.

The form of the sessions was left relatively flexible, allowing the participants to respond to a series of open questions and to introduce other areas of discussion if they felt that they were relevant. As far as possible the author allowed the discussion to evolve freely to avoid constraining the ability of the interviewees to articulate the issue that they felt were significant. However, the adherence to a loose structure was considered essential in order to ensure that all of the interviews included appropriate consideration of the key themes that were intended to be addressed. As such a framework was utilised, based around the following open questions:

- *What you understand by the term POE?*
- *Which models of POE are you familiar with?*
- *Why do you perform POE within your organisation*
- *What are you seeking to achieve from the POE process?*
- *What factors are you attempting to measure?*

- *What are the things that you think are important to building users in relation to overall satisfaction?*
- *How do you think the process of POE could be improved?*

Interview Sample

The basis of selection for the interview participants was discussed in the chapter dealing with research design and will not be discussed again in detail here. However, it is appropriate to summarise the constitution of the interview sample here for clarity. Interview participants were selected based on a simple quadrant analysis exercise to reflect the constitution of the Higher Education sector within the defined research setting.

Group 1 ***POE Applicable*** ***Not Used*** Institution 27 Institution 28	**Group 2** ***POE Applicable*** ***Used without Success*** Institution 31 Institution 32
Group 3 ***POE Applicable*** ***Used with Partial Success*** Institution 8 Institution 11	**Group 4** ***POE Applicable*** ***Used with Success*** Institution 15 Institution 23

Figure 5.8:Interview Sample Quadrant

Analysing the Interviews

Several modes of interview analysis are recognised and their application in social science research is well established. (Kvale S.2007) The nature of interviews as a

research technique is such that the structure, content and interpretation can vary considerably from the original concept and intent. Depending upon the nature and context of the interview the way in which the content is analysed will also vary greatly. The main approaches to analysis of interviews were considered including meaning analysis, language analysis, bricolage and theoretical reading.

The nature of the work resulted in the adoption of meaning analysis, in which the interpretation of words, phrases and constructs within the interview dialogue are sorted and interpreted by a range of processes that seek to provide order and clarity to what can be relatively unstructured commentary transcribed from interviews. The principal techniques adopted for this purpose are:

- Coding:
- Condensation
- Interpretation

The manner in which the content of interviews is sorted and interpreted must be derived from the research questions being addressed and the context of the interviews within the overall research structure and methodology. The more common methods used are summarized below:

- Meaning Coding; which attaches 1 or more keywords to text segments, (also referred to as categorising) after a key aspect in grounded theory

- Content analysis; which allows systematic quantitative description of interview content. This is different from grounded theory approach to coding, which does not need to quantify – but attempts to draw qualitative links between codings.

- Meaning Condensation; which entails abridgement of meanings statements from interviews into shorter formulations.

- Meaning interpretation; which interprets content and goes beyond structuring of the manifest meaning of what is said

- Language Analysis; which interprets syntax or phraseology to derive insight from how things are said rather than what is said.

A combination of meaning coding and content analysis were used to analyse the interviews. A total of eight interviews was conducted, representing a cross sample of institutions that had indicated that they had experienced varying degrees of success in applying the process of POE. Although the structure of the interviews was as far as possible common to all participants it was necessary to allow elements of flexible contribution to the individual interviews to reflect the different levels of experience in applying POE and the varying perceptions of its success. The transcripts of the interviews were analysed with reference to the specified questions and they were also subject to open and axial coding to identify themes that might not be directed to any of the specific interview questions. The resulting coding was used to formulate a series of cross-cutting themes that featured within the discussions. These are summarised in table 5.13 below. The themes identified are discussed alongside the direct responses to the questions posed at interview.

Theme	Interview								Total
	8	11	15	23	27	28	31	32	
Building	1	14	4	9	11	4	4	4	46
Internal Environment	1	4	1	5	6	2	4	2	25
Heat	0	1	0	1	1	0	0	0	3
Light	0	1	0	1	2	0	0	0	4
Performance	0	5	3	4	4	0	0	0	16
Quality	0	2	0	0	1	1		0	4
Ownership/Familiarity	0	1	0	0	0	0	0	0	1
Space & Form	1	2	2	0	1	0	1	1	8
Building Management	0	3	0	0	0	1	0	0	4
Design	5	10	15	7	7	8	3	7	62
Improvement		3	7	4	1		1	6	22
Meeting Brief	2	2	6	2	4	1	1		18
People	0	4	4	2	2	2	0	2	16
Process	8	25	32	11	32	11	11	24	154
AUDE	0	8	1	0	0	1	2	5	17
Qualitative	2	3	6	7	5	1	4	5	33
Quantitative	2	1	3	1	11	1	0	5	24
2 part process	0	1	2	0	1	0	0	0	4
Project	0	4	8	2	1	2	0	2	19
Delivery	0	0	0	0	3	0	0	0	3

Table 5.13: Coding themes within DoE Interviews

Summary of Responses by Interview Question

The questions that were posed during the interviews provided a framework for discussion and the foregoing analysis of resultant coding allowed the development of insight in to the respondents' awareness of POE and their perceptions of its purpose and efficacy. The following summary of the responses to individual questions seeks to link the analysis of the coding directly to the interview questions and to the research questions that they were designed to address.

What you understand by the term POE?

The interview participants all indicated that they had an understanding of the concept of post-occupancy evaluation and its application. There were three broad interpretations of the term, the first being based upon physical and technical evaluation of performance of the building the second being a review of project delivery associated with new buildings or refurbishments and a third view that reflected a combination of these factors.

The view that the process is a holistic exercise that takes in to account both the delivery of the project and the performance of the building in use was reflected in several of the interviews. There was also a view that there were two discrete and identifiable phases or parts to the process, one dealing with project delivery, the other with building performance. The separation of the process in to two unconnected phases was also noted as a common approach for the delivery of POE and the concept of two individual procedures was introduced by two of the interviewees. These perceptions align readily with the general findings from the literature review, which indicated that there are two widely accepted propositions of the purpose of POE as well as its form. These are based, firstly upon the notion of POE as a tool to improve design and project delivery by providing a feed forward process, secondly upon the notion of POE as a real-time tool to manage the performance of buildings in use.

> *'from my perspective in theory a POE should be a comprehensive review of how the, a building has performed in terms of its technical performance, its usability, how it met the brief, how it was procured you know all, the whole process.'*

> *'POE for us is the ability to capture the holistic view of the project process, from its inception through to its completion and its use period. Definitely a two part process'*

An additional issue featured within the interview transcripts that introduced the concept of review and evaluation of project deliverables or design briefs. The idea of reflecting upon the original design brief and undertaking what amounts to an audit of the final building against the original aspiration was put forward by four of the participants. They also introduced the users of the buildings as stakeholders in the design and delivery process with several references to delivery of buildings relative to stakeholders' expectations. This implies an understanding of the process of POE as being something that actually commences before construction, or even design, and which is based more on a quality loop than upon a linear model.

> *'actual use and performance of the building aligned to the scope of works, the brief, the original starting points if you like of a project. I think it's more 60/40 in favour of the occupancy side. Equally important but we drill down and focus more on the project delivery side in a separate review area*
>
> *My understanding of POE is it's an opportunity after say about a year of, after completing a project to check with the various occupants that the, that really the design and the fit out you know whatever has been produced there sort of meets, meets their expectations really from you know from what their original requirements were as opposed to the post completion evaluation which is more about really the process of actually delivering the process, you know delivering the project*
>
> *I am familiar with POE as it was a process adopted by a previous employer for all major projects to ensure that lessons were learned and particularly that project benefits were delivered.*

The connection between the process and the end users was also seen by one of the participants to be a purpose behind the process, rather than simply a mechanism for communicating the outcomes of the process.

> Well I think POE sort of encapsulates by three things. One – it's a review or the success or otherwise of the project in terms of particularly the user experience. Secondly I think it's an opportunity to reconnect, re-communicate with the users in the sense that we use it as a quasi sort of marketing explanation exercise

Which models of POE are you familiar with? (use?)

All of the interview participants were familiar with the broad concept of POE. However, the extent to which they were familiar with specific models was variable. In six of the interviews there was reference to the previous or current use of POE within the organisation. However, in three of these the ability to articulate, in detail, the basis of the model applied was limited. This is perhaps understandable where external consultants are used to effect the process. However, the briefs upon which they are based appear to be very generic and without specific reference to any pre-determined

model. External consultants were cited as being the originators of the models applied in several instances, although the familiarity with the models used, on the part of those commissioning the work was low. In two of these cases there was a perception that the process was not delivering, completely, the outcomes that had been desired.

> *we're using a BRE model at the moment. I've not got any reference information in front of me for that Mike but we are still involved with the BRE. , I don't think there is one that fits all and sometimes we feel that we're not actually getting best representation out of the BRE questions*

Two of the institutions within the interview sample had developed their own models for POE. In both cases these were described as 'simple' or 'basic' and were designed to deliver specific outcomes that fulfilled their needs. This approach was cited as being more economical than the use of more established or expansive models. The degree to which there was a knowledge and understanding of the AUDE model varied between the eight interviewees. All participants had a broad awareness of the existence of the model but none had applied it in practice. There was a recurrent view that it was overly sophisticated or cumbersome and that the cost of applying it would be high. All of those interviewed indicated a preference for a simple model that was easy and economical to apply. The AUDE model was perceived to be highly structured and highly developed but was considered by all to be more detailed and more complex than was necessary. The issue of 'fitness for purpose' of the model was discussed in most of the interviews and there was a broad view that the AUDE model exceeded the requirements, and to an extent, the capacity of most HEI Estates departments.

> *we developed our own forms for this at one stage, our own structure for it which was a fairly basic structure rather than using any of the, well I say any of the industry standards. We looked at the AUDE one but we just thought it was too complicated and we couldn't in the end also get senior management support for using any kind of consultants to come in and help us with that either*

> *I think you know things like the AUDE model that they're really just too heavy. Whether we've got it right with ours, cos ours is very, very simple. Maybe there's a balance to gather better information than we do*

> *the AUDE ones out there, I find, well we tend to use a bit of an a la carte approach on that, its ra, I think it's a sort of counts perfection and you've got to understand as well you know people moved in to a new building or whatever, they're busy you know you go through all of that and you want good coverage as well.*

Why do you perform POE within your organisation?

The principle purpose of undertaking POEs within HEIs was considered to be the demonstration of achievement of defined project deliverables. Although the user satisfaction data is considered to be of great importance it is used in the context of demonstrating that the pre-defined aims and objectives of a building or refurbishment project have been delivered. Two of those interviewed identified their internal or external audit requirements as being a key driver in undertaking a rigorous review or evaluation process. However, the main driver, identified in six of the interviews was the ability to learn from previous projects and to reduce risk and uncertainty in the delivery of future buildings.

> the principal reason why you would do it is to actually understand whether the benefits realisation as set out in the original business case have been delivered

> Have they, have they achieved through use have we been able to demonstrate that we've actually achieved what we set out to do at the beginning.

The responses provided in four of the interviews suggested that there might be different views regarding the reasons for undertaking POE when referring to the reasons why the institution may wish apply the process rather than why the interviewee, as an individual, might wish to do so. The responses to this question were inconsistent between respondents and were, in most cases rather vague. Whilst the individuals generally articulated relatively clear reasons for their application of POE they were challenged in displaying clear understanding of the reasons why their institutions sought to do so. The majority of the interviews included clear reference to due process, although there was limited description of the reasons underlying the application of such. The respondents stated, in most cases, that the application of was rather more than the fulfilling of an institutional audit requirement. However, in all cases, they were unable to articulate the exact purpose and perceived benefit of the process at a strategic or institutional level. This was also reflected by the extreme variability in their descriptions of the way in which the outcomes of the process are communicated, disseminated and applied within the institution. There were several responses that suggested a schism between the outcome of the process, as applied at project level, and the recognition benefits of the process at an institutional level.

> I think the post project reviews we do most of the time and we have been picked up on it by our audit department in the past. For me personally that's not what drives it, I've always done them and always I think its more about what you can learn out of them rather than necessarily going back over and critiquing what you've done its what you can take forward on to the next, cos that projects been done and delivered

What are you seeking to achieve from the POE process?

There was a consistent theme within the responses to this question that reflected an aspiration to learn from experience and to inform future projects to enhance quality of completed buildings. Whilst there was a recognition that the process can be used to address building performance and user satisfaction issues in real time, this was seen by some as a secondary or separate element. Several of the interviewees linked the outcomes of the POE process to the performance of the design team or the audit of the design and delivery process.

> *Areas of improvement that will come out of that, highlight the lessons learnt. Identifying potential weaknesses in our stakeholder engagements. Its its, but its also about rewarding and identifying the successful elements as well. So there's two sides of it. It is about identifying any downsides or any problems or any obstacles but also recognising the benefit of doing it right and rewarding that and giving consistency back to the teams that have been involved.*

In addition to the wish to use the POE process as a learning tool to enhance future projects, the view was also expressed that it fulfilled a quality assurance function. Specifically, it allowed the closure of a quality loop by providing a mechanism for assessing, objectively, if projects had fulfilled their initial design and functional briefs. Although several of those interviewed stressed that the process was not driven, primarily, by the audit requirements of their institutions they indicated that the review of the final building against its initial brief or specification was a key purpose of the process. Linked to this was the issue of measuring the degree to which the building, in its final form, matched the expectations of end users.

> You look at the whole project process from beginning to end and say you know you start at the beginning, and ideally you start at the beginning knowing, at the beginning you set out what you want to review at the end in an idealistic world and you look back and you look at whether, how the building has achieved that and what adjustments you might need to make to correct that particular building or improve it or whatever, or fine tune it and also to use it to inform other projects going forward if there are things that you find from that particular project that might be useful on another project

There was a consistent theme across all of the interviews relating to the use of POE as a mechanism for engaging withy stakeholders and end users. This was considered as a benefit, not simply in connection with individual projects, but as part of a wider process of stakeholder engagement and the longer term process of developing and embedding a series of facilities based KPIs for the institutions. However, in all but two of the interviews the focus for improvement and enhancement was seen as being the process of project development and delivery rather than the technical and functional performance of the building. This was in part linked to a perception amongst the interviewees that the views and expectations of the end users would change as time moved on and that only the first set of users would have expectations that could be used as a benchmark for measurement. Two of those interviewed expressed a strong view that the first set of occupiers would be the only ones who knew what had gone before the final building and that any actions or design decisions based on matching their expectations would be potentially flawed in the context of future users. The view was also expressed that the form and function of individual buildings varied greatly, but that the process of delivery could be considered as more consistent. Hence, greater benefits to the institution are gained from improving the processes by which buildings and projects are designed, procured and delivered rather than attempting to improve technical or functional features that may never need to be replicated.

> We were trying to find out whether we'd actually delivered the building that people thought we were going to deliver in the first place and what, and how it worked for them, whether it met their expectations etc. And we were basically also trying to develop some KPIs in terms of, but that again was more related to the process of delivery than the final outcome.

There was a view that POE was applied as a communication improvement tool as much as a technical or functional tool for the enhancement of building performance. However, four of the interviewees also cited the potential for improving design elements and functional performance in future schemes as key drivers for undertaking the process of POE. There was limited commentary on the function of POE as a real time performance improvement tool and the broad consensus was that the benefit for the organisation was associated primarily with feed forward and iterative design and process improvement rather than for addressing user satisfaction issues at the point of undertaking the POE.

> The biggest thing that comes out of it is how communication, as ever, is absolutely key and how its quite easy for that to go along if you're not careful and just take the edge off a scheme. So I think it's a constant reminder to increase and improve our communication. But it really is to get in to that nitty gritty of how

> we've dealt with specification, how we've dealt with the interaction, what does the design work, is there any comments on how we could have improved the design. And it really is as far as I am concerned to learn from so that the next one we do and the next one we do after that are even better

What factors are you attempting to measure?

Despite the generally expressed view of the interviewees that POE is a process that relates to both the process of project delivery and the performance of the building in use all of them interpreted this question entirely in the context of the latter.

The views of the interviewees were generally consistent in terms of the factors that were identified for 'measurement.' There was a strong linkage between factors relating to internal environmental quality and perceptions of satisfaction factors on the part of the interview participants. This was despite the tendency for them to identify this element of the POE as being less of a driver than that of project delivery and process improvement. Although there was a general indication in all of the interviews that the measurement of building performance was a fundamental part of the POE process there was a lack of specificity in the identification of the factors that were to be measured. Several of the responses to this question included reference to very broad descriptions of factors or vague terminology. Terms such as 'comfort' and 'environment' featured heavily in the responses but without them being defined in to measurable factors.

> That I think will be very focused on the technicalities of the building performance rather than honing the operation of it. Usability and comfort really.

There was also a tendency to cluster sets of factors together based on general recognition of the features that combine to affect environmental comfort. Hence, in all of the interviews the respondents included reference to heat, light and noise (or sound) but they did not generally go beyond these elements other than with very vague reference to other factors, using terms such as 'life issues', 'physical performance' and 'working environment'. In deeper discussion there was a slight suggestion on the part of three of the participants that the factors identified within this question were those that could readily be measured, rather than those that needed to be measured.

> I think its everything to do with their whole working environment you know if they can't work effectively because their too hot and too cold and too stuffy, too cramped. You know too, room too bright whatever. You know bit of draught down their neck from the ventilation system, its all about people feeling comfortable and able to get on with their job I think basically.
>
> Is it, is the lighting right, is the too noisy, is it too quiet. Its those very basic life sort of issues of being based in a building
>
> physical performance of the building and the occupancy of that building, which will include lighting, heating, warm all that sort of stuff.

Only one of the interviewees referred to the issue of users' ability to control their environment. However, this was focused more on the technical operation of the controls rather than the users' perception of control, which was a significant feature within the building users' commentaries analysed in other sections of this chapter.

> The performance of the building relating to its environmental controls

What are the things that you think are important to building users in relation to overall satisfaction?

There was a strong consistency between the responses to this question and the previous question. These questions were intended to allow the author to identify the factors that were considered by Directors of Estates to be significant to user satisfaction and to warrant measurement using POE. A process of analytical coding was applied to identify all references to factors affecting building performance and user satisfaction. Although the majority of references were directly associated with these two questions the entire interview transcript was coded to gain a full appreciation of the factors identified.

Table 5.14 below summarises the results of this coding exercise.

Theme	Interview								Total
	8	11	15	23	27	28	31	32	
Internal Environment	1	4	1	5	6	2	4	2	25
Heat		1		1	1				3
Light		1		1	2				4
Sound		1			1				1
Performance		5	3	4	4				16
Quality		2			1	1			4
Ownership/Familiarity		1							1
Space & Form	1	2	2		1		1	1	8
Building Management		3				1			4

Table 5.14: Summary of coding relating to factors measured using POE

The summary illustrates the broad nature of the comments that were made with 25 references being made to the topic of 'internal environment, but with only 8 comments relating to individual, identifiable themes of heat, light and noise. Only three of the interviewees made specific reference to these defined, measurable factors. The majority of the description of the factors was generic or vague, suggesting that the extent to which they are identified and understood may be limited.

The inclusion of factors associated with internal environmental quality, once again featured strongly. However, the same vagueness of definition also featured in identifying additional factors once those of heat, light and noise were put forward.

> those environmental comfort elements are always going to be very high on the priority lists for the users efficient environmental areas, light, heat , solar gain, noise

Four of the respondents made reference to the general theme of 'performance' but, again did not provide specific definition of what this meant to them in the context of identifiable, measurable factors affecting user satisfaction. There was a similar pattern of response featuring the term 'quality' with three of the participants citing this as an element that was considered important to users. However, there was no definition of the term provided, despite the use of secondary questioning by the author during the interview to attempt to liberate greater depth of explanation.

The theme of space was introduced by 6 of the 8 interviewees. However, this was generally in the context of building performance and benchmarking cost drivers rather than relating to user satisfaction. Only two of the participants identified space as a factor affecting user satisfaction, with specific reference to the amount of space and the linkages or adjacencies between spaces. The issue of perceived ownership of space was not cited as a factor by any of the interviewees other than in terms of it being an undesirable element of building design that could limit flexibility in use.

> the obvious things like you mentioned earlier like temperature and amount of space and you know ventilation, daylight, they're fairly obvious ones. And the less obvious ones are you know just how well the building works for people in terms of you know is the layout right and can they get at things in, that they want to get at and you know can they work efficiently, can they communicate with the right people easily and you know the meeting room's suitable, things like that.

Building management was noted in only two of the interviews. In both cases the reference was specific to the process and quality of cleaning. Both of those who referred to this issue considered this aspect to be highly significant in terms of staff occupiers of the buildings and their perceptions of service quality. In both cases this issue was linked to departmental KPIs within the institution and as such was seen as a key issue for the Directors of Estates.

> *'for instance we had quite a lot of feedback on the effectiveness of our cleaning arrangements and we've restructured the cleaning and caretaking functions specifically for that building as a result'*

Five of the interviewees commented upon the subjective nature of user perceptions and the limitation that this may place upon accurate measurement. In one instance the Director of Estates put forward the view that there was no benefit in questioning users about their satisfaction with environmental factors such as temperature. This was based on their view that where a factor can be objectively measured and benchmarked against a defined standard or required level, the opinion of users was not relevant. The example given was that of temperature.

> a lot of the things that you measure with POE are about environmental factors heat, light, acoustics, noise, all that sort of thing. Its pointless measuring those because if you have a building that's designed to achieve between 19 and 21 degrees Celsius in a space, whether people are too warm or too cold in that space is irrelevant because its achieved its design parameters

The perceived subjectivity of response between individual users relating to the same factor in the same environment was cited as a severe limitation on the process of POE by three of the respondents. However, one of the participants noted that there was a need to appreciate not just what the views of users were, but also why they were their views. This comment was put forward by one of the interview participants that had not applied the process of POE within their institution, hence, it was not possible to explore how they felt that this might be evaluated.

> its very important I understand why the users are satisfied is very important because ultimately that's what makes a difference but its subjective. You could, two different people having exactly the same experience will have different views

How do you think the process of POE could be improved?

The responses to this question varied between those who had had different experiences of the application of the POE process. As might be expected, those whom had not undertaken the process had a limited contribution. However, they did express the reasons why they had not applied the process and some of the commentary on this reflected their perceptions of the process and reasons why they felt it was difficult to apply. These views aligned largely with those expressed by the interviewees that had experience of applying the process.

The main issue that was noted in terms of improving the process was associated with the perceived complexity of existing models. The AUDE model was cited, in particular, as a model that was regarded as complex and bureaucratic. Five of those interviewed identified simplicity and cost effectiveness as two of the primary requirements of an effective and usable POE model. They also indicated that, in their view the AUDE model did not fulfil these characteristics and that this was a major inhibitor to the application of the model in practice.

> I think you know things like the AUDE model that they're really just too heavy. Whether we've got it right with ours, cos ours is very, very simple. Maybe there's a balance to gather better information than we do. But it needs to be really kept as short and concise as it can be. You know if you got a questionnaire that might be perhaps 6 or 7 pages long with space in there for people to put explanations I think that's what it should aim for really. I think anything much bigger than that and you do get that snow blind

The ability of the institutions to undertake such processes within their resource base was linked to the issue of perceived complexity with the AUDE model being viewed as cumbersome and time consuming. In practice it appears that the process that is being applied by most of the institutions represented in the interview sample is based on a rationalised variant of some existing model, such as AUDE. These models are reduced in scale and structure of components in order to allow them to be applied in a manner that is deliverable and which is fit for purpose in the specific context of a particular project.

> Because we felt it would turn in to quite a big bureaucratic process and one of the things, one of the issues we have at Coventry is that we have got a very small team delivering projects and erm so we are very, if you like very light on our feet but also the downside of that is that it, some of our processes do lack structure and we are not particularly good at managing something that was the size of the AUDE.

> we don't use the AUDE one. We looked at it and just felt that it was quite bureaucratic and quite a lot to it for what we were getting, and quite formal in terms of the way it went

There was also a view, expressed by four of the interview participants that the existing models measured or evaluated factors and issues that may not be the most relevant to their own particular circumstances. The went further to express the view that in the case of some models they attempted to measure far too many factors, simply because they could and that in doing so they diluted the recognition of the key factors affecting user satisfaction and building performance. As a result four of the institutions had developed hybrid or bespoke models that they felt were more focused on their own needs and which were suitable for the intended purpose.

> the AUDE one obviously covers you know everything from I think you know, you know sort of lists out everything well you know you just don't have the time to do that so we tend to sort of as I say have a bit of a pick and mix approach and use that as a guide

There was a strong body of opinion to suggest that the concept of a single, generalizable model was inappropriate and that the model used should reflect the particular context and demands of individual cases. This was linked, in two of the interviews, to the perception that undertaking the POE process may be driven by the need to demonstrate that due process has been followed rather than by a real aspiration for learning from the process or applying interventions to enhance building performance.

> The issue I have with POEs is its very easy for people to say it's a box ticking exercise, I've got to do it cos me boss has told me to

In three of the cases the interviewees also posited that the timing of the POE application was such that it did not allow for any real-time intervention and that it could only be of real value in terms of learning for future projects. There was a strong argument presented by two of the participants to suggest that the user satisfaction elements of the model were subject to such variance between user sets that their application, in all but the broadest of terms, might be superfluous in this context. However, this view was countered by the remainder of the interviewees, who considered that user input was a crucial part of improving design through feed forward of lessons learnt.

> unless someone can actually tell me otherwise in terms of I mean quite often POEs definitely after the horse has bolted. I prefer that if you can use POE and use the lessons learnt from POE on to other projects that's where you really get the benefits. i.e you do learn, you don't repeat the same mistakes again.

Overview and triangulation

The results of the qualitative analysis can be considered in terms of supply and demand as illustrated in figure 5.9 below. The users of the buildings, represented by staff and students, constitute the demand driver for the space and its performance. The operators of the buildings, represented by the Directors of Estates constitute the supply function. The relative perceptions of factors that influence overall satisfaction are mapped in figure 5.9. It can be seen that several of the factors identified align readily between supply and demand sides of the dynamic. However, there are clear gaps in the areas associated with local control of the environment, ownership of space, building management and quality and durability. Each of these themes was identified as influential by the users but not by the providers of the space and facilities.

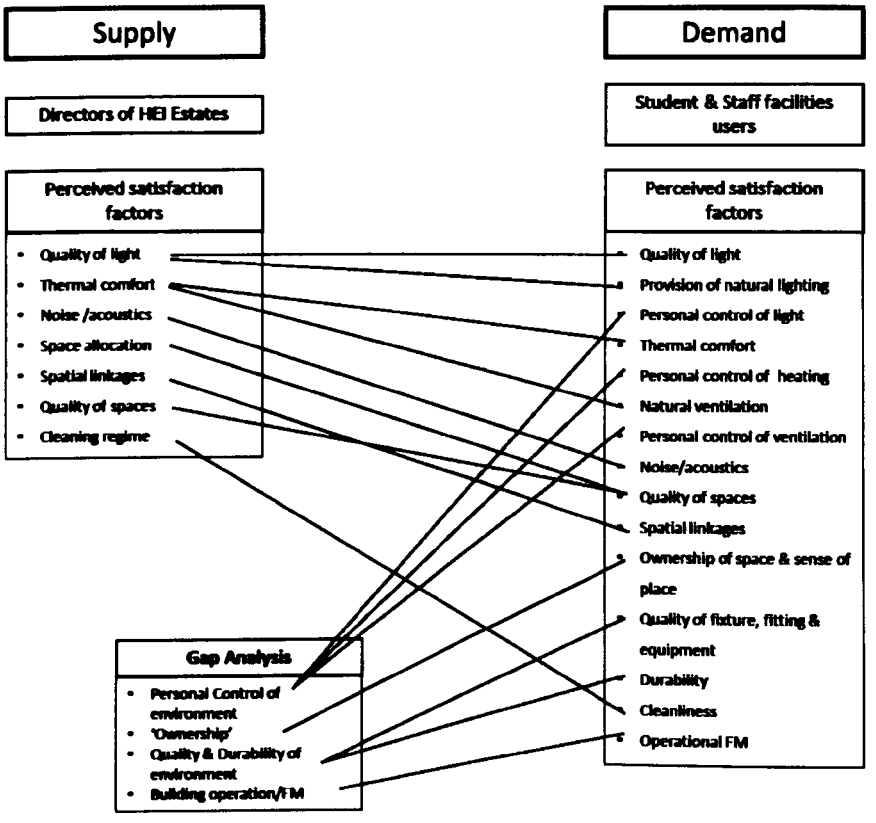

Figure 5.9: Perceived satisfaction factors; supply & demand

The various components that have been utilised in undertaking the research allow the cross referencing of results relative to key themes within the work. Tables 5.91, 5.92 and 5.93 that follow seek to set out the outcomes of the various individual components of the work in relation to key research questions. Whilst the full discussion of the results that have allowed the generation of these tables is set out elsewhere it is useful to provide a very brief explanation of their contents here also.

Table 5.15 summarises the outcomes of the qualitative and qualitative elements of the study in relation to the factors that are perceived as being significant to user satisfaction by the various groups that were included. The table shows the various thematic groups of factors that were identified, including internal environmental quality and aspects of building management and operation. It can be seen that the only theme that features within all elements of the research and which is cited by all participant groups is that of quality, although this term is not consistently defined by the various groups. It was

generally noted that the Directors of Estates comments and observations regarding the factors that they perceive to be significant to user satisfaction are far less specific than those of the end user groups. There are also several factors that are not recognised by the DoEs that are cited in both qualitative and quantitative responses from the end users. This summary clearly illustrates a misalignment between the perceptions of end users and those of building operators regarding the factors that are important.

Table 5.16 summarises the outcomes of the literature review, the pilot phase and the main part of the research in respect of the factors that are identified as influencing the adoption of POE within HEIs. Perceptions of high cost and complexity associated with the process are evident in the outcomes of all stages of the research and there is consistency in the appearance of these themes with the qualitative components of this research and from the wider body of writing associated with the area. In the case of the pilot phase and the main phase of the research there was a consistent theme also associated with the apparent reticence to use existing POE models in favour of amended or hybridised models.

Table 5.17 summarises the findings of each of the components of the work in respect of the perceived purpose and functions of POE. It is clear from both the literature review and the empirical work that there are numerous recognised models and purposes of POE. The qualitative elements of the research illustrated that even within a well-defined sector, with widely recognised drivers behind the process there is still significant variability in the perceptions of the underlying purpose of undertaking POE. The most commonly held views are that POE is a beneficial tool for feeding forward design and delivery good practice, for evolving design briefs and for addressing the performance issues of completed buildings. There was also a perception that the benefits associated with POE could go further in enhancing overall organisational performance issues, although this is potentially inhibited by lack of integration and acceptance of the process at a strategic level.

Factors	Qualitative			Quantitative			
	Building Users		Directors of Estates	ADA		TRB	
	AUDE Qualitative Comments	Focus Groups	Interviews	2010	2012	2010	2013
Air Quality	Presence of natural ventilation Ability to control ventilation	Local control of ventilation	This factor was not cited	✓	✓	✗	✓
Heat	Seasonal temperature consistency User control of temperature Presence of draughts	Local control of heating Effectiveness and sensitivity of thermal controls Seasonal temperature variation Control of solar gain	Broad theme of thermal discomfort	✓	✓	✗	✓
Light	Effectiveness of automated lighting control Users' local lighting control Provision of natural light Quality of artificial lighting Balance of natural and artificial lighting	Access to natural light Access to external views Quality of artificial lighting Overall lighting quality	General quality of light	✓	✗	✗	✓
Sound	Acoustic behaviour of spaces Noise intrusion from adjacent spaces Noise disturbance from building operation and use	Intrusive background noise Noise transfer between spaces Perception of privacy in spaces Acoustic behaviour of spaces.	Noisy environment	✓	✓	✗	✗
Quality	Quality of décor and finishes Quality of detailing and workmanship Durability of fittings and components Overall 'feeling' of quality	Quality of fit, finish and décor Institutional 'brand' Identity and sense of place Detailing and design features Durability of fixtures, fitting and components	Generic theme of quality	✓	✓	✓	✓
FF&E	Durability of fittings and components	Durability & quality of components Positioning & integration of FF&E elements	This factor was not cited	✗	✗	✗	✗
Ownership/ Familiarity	Provision of identifiable spaces Ownership of spaces by discrete user groups Way finding, signage & direction Visible identity of spaces to support group identity Ownership or control of internal environmental quality factors	Provision of identifiable community spaces for staff, students and cohort groups Effective signage and way finding Provision of 'welcome points' Ability to effect local control	This factor was not cited	✗	✗	✗	✗

Factors	Qualitative			Quantitative			
	Building Users		Directors of Estates	ADA		TRB	
	AUDE Qualitative Comments	Focus Groups	Interviews	2010	2012	2010	2013
Space & Form	Identifiable community space for staff and students Provision of storage space Ease of navigation through the building Good quality spaces for specific activities	Matching users expectations of space and form Identifiable space for user group 'communities' Provision of social or community space Effective & intuitive circulation space and way finding	Quantity & size of spaces Linkages and adjacencies	✗	✗	✗	✗
Building Management	Cleanliness Management of activities generating noise within the building Effective maintenance	Cleanliness Building condition & maintenance Condition of public spaces Day to day facilities management Furniture configuration	Cleaning regimes	✓	✓	✗	✗
Security	Not significant	Not significant	This factor was not cited	✓	✓	✓	✓

Table 5.15: Summary of factors cited as influential upon overall satisfaction

Factor	Literature Review	Pilot Phase	Director of Estates Interviews
Complexity of process	Complexity of existing models was cited as a recognised barrier to the widespread adoption of POE in generic context. The issue of perceived complexity was commonly a feature rather than actual complexity of the models.	Models within HE, including AUDE, were perceived to be overly complex and difficult to apply, Desire for simple models was expressed. The perceived complexity of standardised models was identified as a barrier to use of POE. Bespoke or hybridised models are favoured as a result	AUDE and other standardised models were subject to criticism for perceived extent of complexity. Not necessarily aligned to institutional needs despite high levels of data being gathered.
Cost of process	Cost of application of POE was noted as a recognised generic inhibitor to use of POE.	Cost of undertaking POE was considered as a limiting issue within HE institutions. There is a perception that more sophisticated models cost more to implement	Cost was noted as one of the major factors limiting the adoption of POE within HEIs. Linked strongly to perceived complexity of established models and considered a driver for use of bespoke approaches.
Cost of addressing outcomes & increased expectations	Literature indicates that organisations can tend to be reluctant to adopt POE due to potential for additional costs of rectification of issues and increased occupant expectation.	This issue was not cited	There was reluctance to act upon all outcomes of POE on a 'knee jerk' basis. The view was expressed that only very significant issues would be subject to remedial action in the short term, a watching brief being operated for others over time.
Complexity & consistency of data	The outcomes of analysis in different cases indicate that the data liberates varying results in terms of referencing key factors influencing performance and satisfaction	The consistency of data was linked to the ability of non-technical users to respond to technical questions. The variability of data between instances was also noted.	Potential for inconclusive data was noted along with implications of analysis requirements for high volumes of data
Cause and effect linkage	Variability was described in identification of factors influencing overall satisfaction in different scenarios. Time difference between applying interventions and identifying outcomes or benefits was cited as a limiting factor.	This issue was not cited	There is a degree of scepticism regarding the extent to which interventions based on POE will liberate the positive end result that is desired. A degree on user negativity is considered to be expected within HEI facilities.
Usefulness of data	There is evidence of clear positive outcomes from POE with a deal of good quality data derived from case studies and research projects. There is also a view among several commentators that the alignment of the data gathered and analysed must align with the specific needs of individual setting	Perception that the use of standardised models can lead to data that is too generic to be of use in a specific context.	There is a strong perception of data being too generic and too complex for real impact upon facilities use. This is a driver to the use of bespoke models and an underlying reason for scepticism among senior managers and estates operators about the usefulness of POE.

Table 5.16: Summary of factors influencing Adoption of POE

Purpose	Literature Review	Pilot Interviews	Landscaping Questionnaire	Director of Estates Interviews
Design Data	Historical application and development of POE has liberated considerable design data. There is an aspiration to build a central body of design information through RIBA, PROBE etc but it has not resulted in widely accessible data. Individual users/sectors have made steps towards this.	Design data is seen as a local issue with respondents indicating that they value the build-up of design data but that it is not widely shared	This factor did not feature strongly within the landscaping questionnaire responses.	Design data is seen as a valuable outcome of POE by some participants but the focus tends to be on local issues. The extent to which design data is collated and shared is highly variable with attention paid more to internal systems rather than sector wide dissemination.
Input in to future Design briefs	The feed forward of lesson learnt is consistently seen as one of the primary purposes for the use of POE.	The use of lessons learnt from previous projects is recognised as one of the key outcomes of the POE process. This is consistently cited as one of the main reasons for undertaking the process. The focus of the lessons learnt ranges between technical design issues and procurement/project delivery issues.	The use of lessons learnt from previous projects is identified in a large number of the responses to the landscaping questionnaire and associated commentary. It is cited as one of the key outcomes of the POE process.	Feeding in to future design briefs is seen as a primary function of the POE process. However, it is noted that the lack of similarity in projects inhibits some technical and functional aspects. A major focus is the project delivery process and the informing of procurement decisions.
Improving organisational performance	The concept of POE as a tool to enable the effective delivery of strategic objectives is recognised. The impact of user satisfaction on productivity, linked to facilities and buildings performance is noted. This is referred to in academic writing as a key factor for POE but is less well supported in practice.	This area was not considered as a strong influence upon the decision to apply POE .It was recognised as an aspiration of the process but POE in practice was seen at a more technical and functional level.	This factor did not feature strongly within the landscaping questionnaire responses.	The linkage between POE and wider organisational agenda was noted and considered as a good aspiration. However, internal processes and potential lack of recognition of the impact of estates and the role of POE within the senior management may inhibit this.
Improving building or facility performance	The improvement in performance of existing buildings in-use is cited by numerous commentators as a primary outcome of POE. However, there is divided opinion on whether this factor or that of design improvement is the key principle of the process.	This was consistently cited as one of the main reasons for undertaking the process.	This is cited by many respondents as one of the main reasons for undertaking the process. However, it is not exclusively recognised as such, with many respondents identifying design feed forward and project process improvement as stronger drivers.	This is identified by most interview participants as strong reason for undertaking the process. However, respondents identified design feed forward and project process improvement as stronger drivers.
Addressing poor performance	This aspect was cited as a potential reason for the adoption of the process in some academic writing but there is limited evidence of its application in practice.	This was not considered as a driver for the application of POE. The perception is that such issue would be dealt with through more routine facilities and building management	This factor did not feature strongly within the landscaping questionnaire responses.	This was not considered as a driver for the application of POE. The perception is that such issue would be dealt with through more routine facilities and building management

or specific defect		mechanisms.		mechanisms.
Audit requirement	The development of more rigorous financial and operational performance measures within the commercial environment and within HE has raised the profile of this issue but it is not cited as a major driver for POE.	This was cited as one of the reasons for undertaking the process although it was not considered as a primary driver.	This was cited as one of the reasons for undertaking the process although it was not considered as a primary driver.	This was cited as one of the reasons for undertaking the process, with increasing prominence within HEIs. It was not considered as the primary driver. However, in a small number if instances it was seen as the most recognised purpose of POE at a senior level within HEIs.
User satisfaction	This was cited as one of the major drivers behind the application of POE. The impact of user satisfaction upon facilities is cited consistently in a wide range of contexts and settings.	This was cited as one of the main reasons for undertaking the process although the linkage between user satisfaction and demonstrable tangible benefit in facilities terms varied.	This was cited as one of the reasons for undertaking the process although it its linkage with measurable performance outcomes was limited.	This was cited as one of the key reasons for undertaking the process and it was considered by some as a primary driver. The views on this aspect varied greatly with some interviewees displaying extreme scepticism regarding the extent to which user satisfaction could be linked to facilities performance.

Table 5.17: Summary of perceived purpose of POE Process

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5.4 Summary

The results that are set out within the foregoing sections allowed the author to infer that the existing approach to the application of POE within Higher Education is potentially compromised by several factors. These fall in to two broad areas of consideration. Firstly those factors associated with the content and outputs of existing POE models and, secondly, those factors associated with the structure of the POE process and the manner of its application. There is little doubt that the potential benefits of the POE process are considerable and that it is recognised as a tool for the enhancement of the design and performance of facilities and buildings in a range of settings. The extensive body of literature that has been reviewed indicates that the various approaches that have been developed to POE are well grounded and based upon sound theoretical underpinnings. In addition there is an extensive body of literature that identifies and evaluates the key factors that have been cited as influential upon user satisfaction within buildings and facilities. The strands of work that have been undertaken by previous researchers within the fields of facilities management, building performance appraisal, design improvement and environmental psychology converge to support the case for the use of POE for design evolution and building performance enhancement. The concept of using a structured and systematic approach to assessing the performance of buildings in use by evaluating technical, functional and behavioural factors has clear merit. In addition the potential for delivery of tangible benefits across a range of themes is well recognised. Numerous commentators upon the POE process present strong and valid arguments to support its effective application as a strategic and tactical tool for evolving and enhancing the performance of facilities.

The context of POE within Higher Education institutions is quite specific in terms of the nature and form of the physical estate and also in terms of the demands and expectations of those who operate and those who occupy and use their facilities and buildings. Varcoe (1995) noted that organisations, including Universities, are continually striving to improve efficiency in response to increasing user expectations and potentially increasing operating costs. It has been noted that HEIs have the potential for inclusion of a broader range of buildings within their portfolios than some other organisations, with quite diverse and specific operational needs. At the same time it is recognised that they contribute most effectively to improved performance when fully integrated in an organisational strategy for academic

delivery rather than as abstract assets or facilities. (Moohan,1993). As with any organisation that utilises a physical facilities structure Universities and HEIs can benefit from the identification and application of facilities performance measures. These can assist in providing a mechanism to learn from past experience and to evaluate trends in the expectations and use of HEI facilities (Avis, 1995).

Key findings from this phase of the work are fall within two broad categories; those relating to the purpose and process of applying POE and those relating to the form and content of POE models. They are summarised as follows:

Perceived value of the process: The potential value and usefulness of POE as a tool for both performance evaluation and iterative design improvement was cited consistently within the literature review and the various interviews that were conducted. However there were differing perceptions across the sector regarding the specific purpose of POE. There are strong and well-articulated drivers at a sector level to support the application of POE, as exemplified by the creation of a specific HE model by HEFCE and AUDE. The Higher Education sector is currently in a state of flux and HEIs are seeking to enhance their performance and deliver facilities that achieve users' expectations and enable the delivery of institutional strategic goals. However, there is evidence that the senior managers within some HEIs view the process of building performance evaluation as being disconnected from the wider strategic agenda. As such the perceived value of POE and its outcomes is highly variable across the sector.

Complexity: It was a consistent view among those interviewed in the main phase of the work that the perceived complexity of the AUDE model was an inhibitor to its use. This was also identified within the literature review in relation to several of the established POE models available. The research produced a finding that there is a reluctance within the Higher Education sector to adopt the AUDE model in full with a preference for the use of bespoke, or custom-made POE models within individual universities or colleges. This is despite the fact that the AUDE POE toolkit is designed to allow variation and selection of components suitable to specific needs. Although it seeks to provide an approach that can be tailored to the needs of specific projects it is seen by many estates directors as a complete template that is complex and potentially costly.

Cost: there was a strong body of opinion that suggested the cost of the process was a significant factor in its level of adoption. Several references to this aspect also featured within the literature review and there was a direct linkage with the commentary regarding perceptions of excessive scale and complexity of the model. The cost of undertaking the process was cited as a barrier to its adoption along with the potential costs of rectifying issues that may be identified as a result of its application.

Variability: the application of the quantitative elements of the AUDE model indicated that the results of questionnaire based approaches liberated results that were inconclusive and which varied between individual applications. The literature review and the interviews with Directors of Estates suggested that application of both standardised and custom-made POE models liberate results that are highly variable in terms of achieving the intended goals of the process at operational and strategic levels within HEIs. The empirical work revealed that the data that is derived from the POE process tends to be inconsistent, liberating different results between individual buildings and differing results in the same buildings over time. This is particularly so in relation to the quantitative data gathered through questionnaires regarding building performance. Here the degree of variability in the results renders the data of limited value in assessing overall satisfaction.

Link to Institutional Goals: The degree to which the outcomes of POE inform, and are informed by, organisational strategy and institutional goals is limited. Although there is an aspiration that lessons should be shared across the sector through the dissemination and publication of POE results there is no evidence that this occurs. Most HEIs retain the data arising from POEs within their own institution and the degree to which it is shared internally is itself variable. The mechanisms for reporting and acting upon the outcomes of POE within HEIs are highly inconsistent between institutions.

Content of the POE Model: Many POE models, including the AUDE model contain quantitative components in the form of questionnaires that seek to measure users' perceptions across a range of factors that are considered to impact upon overall satisfaction and perception of building performance. The work revealed that perception of satisfaction on the part of building users is not associated with a

consistent set of factors relating to environmental quality or building form that can be generalised across HEIs. However, the perception of overall satisfaction does correlate with perceptions of 'quality, although the term 'quality' is not subject to a generalised definition. Directors of Estates tended to have broad views on the factors that they considered influential upon overall satisfaction. These tended to focus on the physical and technical factors of buildings although they are not generally able to identify them in specific terms. The results of the study indicate that there is a gap or mis-match between factors considered relevant by users and those identified by Directors of Estates. This mis-match is reflected in the content of existing POE models.

At the outset of the study the Primary Hypothesis and a series of sub-hypotheses were put forward. The research that has been undertaken has sought to test these hypotheses with the following outcomes.

The primary hypothesis was that:

Existing models of POE have developed to become overly complex and costly in application. As a consequence the use of POE as a facilities performance enhancement tool is inhibited. Effective utilisations of POE as a performance enhancement tool within the HE sector requires the development of a pragmatic model derived from specific user requirements in the given context.

The outcomes of the study indicate that this hypothesis is proven

The sub-hypotheses were as follows:

That:

The application of POE is inconsistent across the Higher Education sector in England and Wales and is compromised by differing drivers on the part of those applying them

The outcomes of the study indicate that this sub-hypothesis is proven

Assessment of building user satisfaction in HE environments using existing POE models tends to liberate inconclusive results

The outcomes of the study indicate that this sub-hypothesis is proven

The perceptions of key factors influencing user satisfaction differ between building users and building operators

The outcomes of the study indicate that this sub-hypothesis is proven

Whilst the findings of the empirical work have been summarised in the foregoing pages it is still useful to provide a review of the main points as follows:

- POE is seen as having different purpose by individual stakeholders, depending upon context and prior knowledge.
- POE is seen variously as a tool for: Feed forward of lessons learnt, design evolution and enhancement of performance in use.
- Users' experience and expectations vary with some expressing concerns regarding value and usefulness of the process.
- Key barriers to adoption of POE include perceived cost and complexity, links to organisational strategies and lack of understanding by senior stakeholders.
- Some models of POE are perceived as complex, including AUDE.
- Acceptance and integration of POE within organisations varies greatly.
- There is a general tendency within HEIs to favour amended, tailored or fully bespoke models of POE over standardised templates or models, such as AUDE.
- Repeated application of the same model does not liberate consistent, generalizable results over time or between parallel settings.
- Factors measured by the AUDE model do not align with factors perceived by users as influential upon satisfaction.
- Correlation between individual factors measured using AUDE and overall satisfaction is inconsistent between applications, with the exception of perceived quality of spaces.

These outcomes are reflected upon and reviewed in the following chapter.

6.0 Discussion of Results Proposition of POE Model

6.1 Introduction

This chapter brings together and reflects upon the findings of the various elements of data gathering and analysis. The intention is to present and discuss the individual findings and to cross reference them to allow the presentation of overall outcomes from the research. On the basis of the overall findings propositions are put forward for the development of a refined POE model for use with Higher Education institutions.

6.2 Principles of POE model design

In considering the proposition of a revised model for the application of POE within HEIs it is essential that the fundamental purpose of the process is established. The earlier stages of the research identified that there are numerous models of POE in existence, with several focused specifically upon the area of Higher Education facilities. However, it is clear that there are still significant barriers to the adoption of POE within the English Higher Education sector. These barriers are reflected in other sectors also, including healthcare and the wider commercial arena. The work undertaken by the author suggests that the development of yet another model of POE would be equally as ineffective as the previous attempts at creating standardised models for building performance evaluation. There are numerous models for POE in existence with at least 50 alternatives being identified within the UK. Each of these have their own merits and drawbacks, however, the failure of the industry as a whole and the Higher Education sector in particular, to adopt a single model or framework is indicative of the basic failing of all standardised POE models. That is the inability of a standardised model to reflect the unique circumstances and context of individual buildings in use. This is compounded by the nature of the data collected through the process, which may be complex and is unlikely to align totally with the specific needs of any particular project. This is particularly so in the case of the quantitative data which features heavily in many of the models of evaluation that are currently in use.

The empirical work undertaken by the author liberated the following broad findings:

- *The usefulness of POE as a tool for both performance evaluation and iterative design improvement is recognised by designers and facilities managers. (see chapter 2 literature review)*
- *Those applying POE within HEIs have differing perceptions across the sector regarding its purpose and usefulness. (see chapter 2 literature review and chapter 5)*
- *There are strong sectoral and institutional drivers to support the application of POE as HEIs seek to continuously enhance their performance and achieve user satisfaction. (see chapter 2 literature review)*
- *Within the Higher Education sector there is a preference for the use of bespoke (custom-made) POE models within individual universities or colleges. This despite the development of the extensive and well-constructed AUDE POE toolkit that seeks to provide an approach that can be tailored to the needs of specific projects. (see chapter 4 pilot phase))*
- *The application of both standardised and bespoke POE models has liberated varying degrees of success in achieving the intended goals of the process within HEIs. (see chapter 2 literature review and chapter 4 pilot phase)*
- *The results of data gathering and analysis achieved from the POE process tend to be inconsistent, liberating different results between individual buildings and differing results in the same buildings over time. (see chapter 2 literature review and chapter 5 empirical work) In particular, the quantitative data gathered regarding building performance through user questionnaires deliver inconsistent results that are of limited value in assessing overall satisfaction.*
- *The perception of satisfaction on the part of building users is not associated with a consistent set of factors relating to environmental quality or building form that can be generalised across HEIs. However, the perception of overall satisfaction does correlate with perceptions of 'quality, although the term 'quality' is not subject to a generalised definition. (see chapter 2 literature review and chapter 5 empirical work)*
- *Those seeking to evaluate building and facilities performance recognised the physical and technical factors of buildings as being key to user satisfaction. However, they are not generally able to readily define specific factors or metrics to be evaluated. (see chapter 2 literature review and chapter 5 empirical work)*

- *The degree to which the outcomes of POE inform, and are informed by, organisational strategy and feed forward of lessons learned is highly variable. (see chapter 2 literature review and chapter 5 empirical work)*
- *The mechanisms for reporting and acting upon the outcomes of POE within HEIs are highly variable between institutions. (see chapter 2 literature review, chapter 4 pilot phase and chapter 5 empirical work)*
- *The most significant barriers to the adoption of POE within HEIs are seen to be cost, complexity, inconsistency or vagueness of outcomes, lack of connection to strategic planning and inconsistent support from senior management. (see chapter 2 literature review, chapter 4 pilot phase and chapter 5 empirical work)*

These findings have informed the proposition of a framework for the pragmatic application of POE within HEIs. The original aspiration on the part of the author was to develop a tailored, standardised, POE model that could be readily applied within Higher Education settings. However, the results of the research have indicated that such an approach is unlikely to liberate tangible benefits over existing models and tools. All POE models are essentially comprised of a range of established qualitative and quantitative components. The various models differ in the way that such components are assembled in to a complete framework, or in the way that they are applied and interpreted. It is clear from the work undertaken within this project that the challenge is to identify and apply these components in the correct manner with the correct focus for each individual project. Hence, the focus of the author's proposed 'model' is aimed at a structured mechanism for identifying the specific requirements of POE for each individual instance based upon a consistent set of criteria. The aim then being to facilitate the selection and use of appropriate qualitative and quantitative techniques for data collection and analysis. Thus the proposed model seeks to ensure that the scope and content of individual POEs is tailored appropriately to the needs of individual institutions and individual projects rather than presenting a template POE solution for general application.

6.3 Development of a Pragmatic model

Based upon the research that has been undertaken the author has identified a series of barriers to the effective adoption and embedding of POE within HEIs. In order to overcome these barriers any pragmatic model of application must adopt a

set of core principles. The barriers identified and the responding principles, which form the basis of a framework for developing a pragmatic model for the application of POE are set out in table 6.1 below.

Issues/ Barriers to implementation of POE within HEIs		Responding Principle for pragmatic model of application of POE within HEIs	
B1	Existing models are costly to apply	**P1**	It should be cost effective
B2	Existing models tend to be perceived as complex in terms of delivery and analysis often requiring external consultant input	**P2**	It should be perceived as free from excessive complexity
B3	Participation in existing models by facilities users tends to be time consuming, resulting in reluctance to engage with the process	**P3**	It should not result in excessive time input from participants
B4	Standardised models tend to liberate generic data that does not necessarily align with specific institutional needs	**P4**	It should allow effective assessment of performance measures linked to institutional goals
B5	Existing models tend to measure a standard range of factors associated with user satisfaction although factors influencing satisfaction vary from case to case.	**P5**	It should allow effective assessment of user satisfaction through measurement of key performance attributes or factors appropriate to individual circumstances
B6	There is limited connection between the outcomes of POE and institution level management and strategy.	**P6**	It should inform institutional action plans and strategies to enhance facilities performance
B7	Results of POE are often archived without structured approaches to feeding forward experience to enhance future project design and delivery.	**P7**	Lessons learned should be effectively communicated to ensure enhancement of future projects.

Table 6.1: Barriers to adoption of POE and responding principles for model development

Each of these principles is considered in greater detail below.

Principle 1: It should be cost effective

One of the key barriers to effective implementation of POE generally and within the HE sector specifically is the cost of its application. (See Literature Review) The direct costs of applying the POE process may be significant and there is still scepticism surrounding the value of the process in some quarters, notably within the leadership levels of some HEIs. There is also a concern that the costs resulting from undertaking the process will be potentially significant if the outcome of the process indicate the need for alteration of buildings or other form of corrective intervention. Users of POE within HEIs favour a cheaper, less detailed approach to the process even though extensive research has been undertaken to inform the development of

models such as the AUDE toolkit. Numerous institutions within the sector have taken the approach of developing custo-made models or of applying selected parts of other existing models in an attempt to reduce cost and time input and to align the process with their individual needs. Several institutions have commissioned external consultants to undertake POE assessments. Whilst this provides an objective approach to the process it also has the potential to increase associated costs. One key element perceived to contribute to the high cost of POE application is the inclusion within existing models of components that are not, necessarily, required in each individual case. A response to the issue of cost and cost effectiveness is to ensure that the process is lean in terms of incorporating only those features that are required in any specific instance of application and by ensuring that it is steam-lined and simple in application. However, the cost associated with the development of fully bespoke models is not inconsiderable. Hence, there is an argument for utilisation of components from existing models, of which there are many, based on informed selection and fitness for purpose. There is also an argument to adopt an approach that allows for a less detailed, low cost assessment tool that has the potential to be followed by more detailed evaluations if they are required. One of the key findings of the empirical work was that data liberated through the use of questionnaires relating to quantitative analysis of performance factors is inconsistent and inconclusive. For this reason the validity of inclusion of such elements within a cost effective POE model must be questioned.

Principle 2: It should be perceived as free from excessive complexity

The perceived complexity of existing POE models both within HEIs and in a wider arena has been consistently cited as a major barrier to successful implementation of POE. Whilst significant research has been undertaken over many years to support the development of sophisticated POE models, including specific frameworks for use in Higher Education, they are still not widely accepted. There is a stated view that the academic basis of such models is sound and that they are well grounded upon theory. However, the perceived complexity of their application in practice is the most commonly voiced criticism, which is seen a key factor in influencing choice of potential users of POE. Despite the existence of numerous structured models, frameworks and toolkits, a significant proportion of HEIs choose to adopt bespoke or hybrid models that they see as better suited to their needs and less complex in application and analysis. Perceptions of complexity and scale can potentially be

reduced through the use of custom-made models that apply fewer component parts. However, the generation of entirely bespoke models for case by case application mitigates against the aspiration to develop a knowledge base for feeding forward to future projects as there will be a limitation on like for like comparison. It must be remembered, however, that building performance is, by its nature, a potentially complex area and its evaluation can only be simplified up to a point without undermining the benefits that are intended to be liberated. A key finding of the literature review and the empirical work is that the use of lengthy questionnaires, often extending to more than 100 questions is one of the most commonly cited factors to support the perception that POE models are excessively complex. This supports an approach that limits the extent of data gathered through such mechanisms to a reduced set of more focused factors based on specific needs of individual projects.

Principle 3: It should not result in excessive time input from participants

The literature review and the empirical work indicate, strongly that the ability to engage with users in a meaningful way is inhibited if the required time input is too high. This is manifested through reluctance to participate in interviews and focus groups. There is also strong evidence that long questionnaires are ill-favoured by respondents and often result in only partial completion or non-completion by respondents. Some existing POE models adopt questionnaires which include well in excess of 100 questions. Given that the research suggests that there is inconsistent correlation between individual factors and overall satisfaction, the value of data relating to factors that do not link to satisfaction must be questioned. The time input required from participants can be potentially reduced by including evaluations of only those factors that are significant in each specific application of POE rather than by adopting a set of generic indicators. Such a proposition requires that the key factors associated with the performance requirements of each individual project are established at the outset of the POE design.

Principle 4: It should allow effective assessment of performance measures linked to institutional goals

The assessment of performance of facilities in HEIs has been identified to include the need to reference institutional goals in terms of ensuring an enabling environment for academic functions and other activities. The definition of appropriate performance indicators and suitable metrics for their measurement is key to the successful application of any POE model. Although the majority of existing models seek to evaluate facilities performance against criteria that support institutional agenda they tend to focus on the technical and functional parameters of performance. This may contribute to the perceived schism between the perception of value of the POE process between operational facilities and estates managers and senior institutional leaders. Increasing recognition of the wider performance context of buildings and facilities within the strategic framework of Higher Education institutions has begun to influence the desired outputs and outcomes of facilities performance evaluations. The technical and functional performance characteristics of facilities must be considered as part of a wider scenario in which their financial performance and the extent to which they enable successful delivery of the core business also feature. The evaluation of performance on such a basis requires inclusion of several dimensions that include physical and functional aspects together with key strategic dimensions of institutional agenda. The increased focus upon financial performance of facilities and upon student satisfaction and perceptions of service quality suggest that a framework incorporating these dimensions also is required. This is important to ensure that the process of POE within HEIs is successful in extending beyond simple technical appraisal of a building's functionality to be an effective tool to support strategic institutional goals.

Principle 5: It should allow effective assessment of user satisfaction through measurement of key performance attributes or factors

The complexity of functions facilitated by academic buildings and facilities makes the selection of suitable indicators potentially difficult. There is the potential to adopt an expansive set of indicators that can result in the creation of an overly sophisticated and complex model. Such models have been developed previously and the research has shown that they tend to require extensive time input from participants as well as detailed and laborious analysis. This has been identified as a

negative factor in the drive to encourage widespread implementation of the performance assessment of Higher Education facilities. It is further compounded by the finding that qualitative data tends to be inconsistent between similar applications in the same research setting and between different buildings within the same institution. In addition the findings indicate that different set of physical or environmental factors correlate with overall user satisfaction in different instances, preventing the generation of any generalizable set of factors that can be used to assess or predict overall satisfaction. The exception to this is the factor of thermal comfort, which features consistently within previous research and which was reinforced through the empirical work of this project. The various other environmental quality factors such as acoustic comfort and lighting feature with varying degrees of consistency between different setting and in different instances of performance evaluation.

However, the concept of 'quality' features consistently as a key factor influencing user satisfaction and perceptions of facilities performance. The term is used with reference both to perceived quality of the physical environment and the degree to which it supports the delivery of users' expectations of experience. The exact nature of the components that make up the construct of quality is variable. Within the study the author noted issues such as decorative quality, quality of fit and finish and general quality of the construction. Issues associated with the management of the facilities also feature within the construct, with cleaning being a consistent factor within the empirical work undertaken by the author. Establishing the principles and indicators of 'quality' is a key part of the assessment of user satisfaction and the extent to which a facility performs against the expectations of the users. The application of service quality models has been established in other arena to assist providers in establishing and meeting user expectations. There is a strong argument for the consideration of similar principles within POE. Figure 6.1 below, developed from the customer service model described by Parasuraman et al (1985) illustrates the conceptual interaction between facilities operators and facilities users in terms of users' perceptions of quality. For the POE process to be effective in assisting operators to deliver facilities that achieve users' expectations of quality it must measure what is actually important to users. The research project has found that what is measured within existing models is largely driven by operators' perceptions of what factors are significant to users. The literature review, pilot phase and main phase of the research indicated that operators' ability to define such factors with any degree of specificity is limited. As a result the existing models of POE tend to rely on

standard templates which set out numerous factors associated with environmental comfort, physical configuration and so forth irrespective of relevance to specific circumstances. Any valid POE model must start out on the basis of establishing the factors that are genuinely significant to users before generating or selecting the data collection tools to be used.

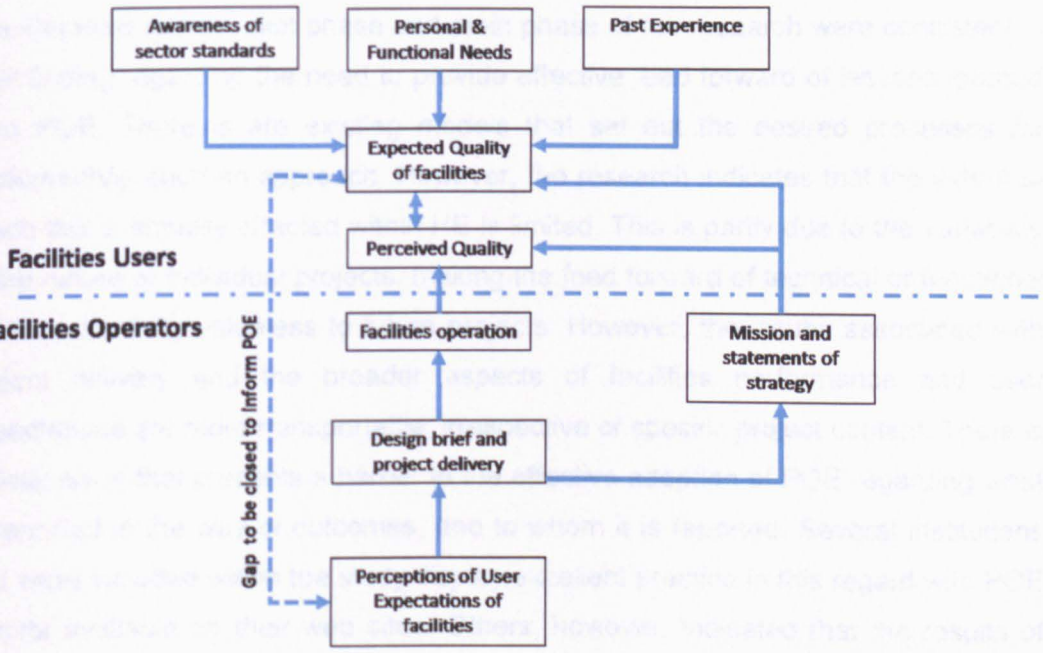

Figure 6.1: Interaction between users' and operators' perceptions of quality

Principle 6: It should inform institutional action plans and strategies to enhance facilities performance

One of the criticisms of existing models of POE is that the outcomes lack relevance to institutional strategies and as a consequence the results are potentially relegated to the position of being archived records of individual project audits. This is largely due to the fact that the briefing for POEs tends to be in abstract from the wider strategic operation of the institution. Some POE models that already exist (most notably AUDE) attempt to ensure that the application of the evaluation process is linked to institutional drivers. However, in practice the models tend to be applied by estates teams as a process for the technical evaluation of building performance against measurable technical and functional criteria. The linkage to the wider institutional imperatives is often lacking because POE is not seen as a strategic

management tool by the higher institutional management. For effective adoption of POE it is necessary for there to be a more structural connection between the POE process and the institutional plans and strategies.

Principle 7: Lessons learned should be effectively communicated

The literature review, pilot phase and main phase of the research were consistent in their finding regarding the need to provide effective feed forward of lessons learned from POE. There is are existing models that set out the desired processes for implementing such an approach. However, the research indicates that the extent to which this is actually effected within HE is limited. This is partly due to the variability in the nature of individual projects, making the feed forward of technical or functional issues potentially valueless to future projects. However, the issues associated with project delivery and the broader aspects of facilities performance and user expectations are more transportable, irrespective of specific project context. There is a clear issue that presents a barrier to the effective adoption of POE regarding what is reported in the way of outcomes; and to whom it is reported. Several institutions that were included within the study display excellent practice in this regard with POE reports available on their web sites. Others, however, indicated that the results of POE were effectively archived once they had fulfilled the audit requirement of the specific project. Project participants indicated that this was a consequence of two main factors. Firstly, the lack of recognition within the institution that the results of POE are meaningful and credible and, secondly, that there is a disconnection between the operational evaluation of the facility and the strategic operation of the institution. Hence, the feed forward loop that is aspired to by the many users of POE as described by Steinke et al (2010) is potentially applied but only at an operational estates department level, without feeding in to the wider context of the institution as a whole and the HE sector. These issues may be overcome by ensuring that POE addresses issues that are seen as relevant to the whole institution as well as individual projects and by recognising that the outputs must be credible and meaningful to ensure acceptance at an institutional and sector level.

Description of the model

The foregoing principles are derived from the findings of the literature review and the empirical research that has been undertaken by the author. The proposed model of

POE within Higher Education is derived from these principles and is based on the balanced scorecard approach that has been utilised in different settings associated with general business and organisational evaluation,

The original aspiration of the author was to refine one of the existing POE models to ensure its relevance to current HE needs. The complex nature of the quantitative tools that are in existence was thought, initially, to offer the potential for simplification through the application of techniques such as factor reduction. However, the results of the research indicated that such an approach was inappropriate for the following reasons:

- *The non-normal distribution of data associated quantitative evaluation components mitigated against factor reduction techniques.*

- *The factors that are perceived as significant to overall project success extend beyond the functional and technical performance dimensions.*

- *The analysis of quantitative data indicated that there was no evidence of the existence of a consistent, generalizable set of factors that correlated with overall satisfaction with a building or facility.*

- *Users perceptions of satisfaction appear to correlate with perceptions of .quality' both in terms of physical quality and perceived service quality.*

- *The acceptance of the principles of POE at a senior, strategic level is related to the extent to which the outcomes inform strategic institutional drivers and performance expectations.*

As such the limitations of existing models, particularly those based, primarily, upon quantitative factors were recognised in that they tended to focus upon functional and technical factors. They did not necessarily reflect a strategic, institutional need in terms of wider strategic drivers such as financial and institutional KPIs. This led the author to seek to identify an approach that reflected this wider context and which could allow the development of a targeted, bespoke POE approach to individual projects, whilst retaining a consistent framework. This could be achieved by adopting a balanced scorecard approach, such as those adopted in other sectors such as healthcare. Figure 6.2 illustrates the findings of the various stages of the

project and the manner in which they informed the conclusions of the work and author's proposition of the balanced scorecard model.

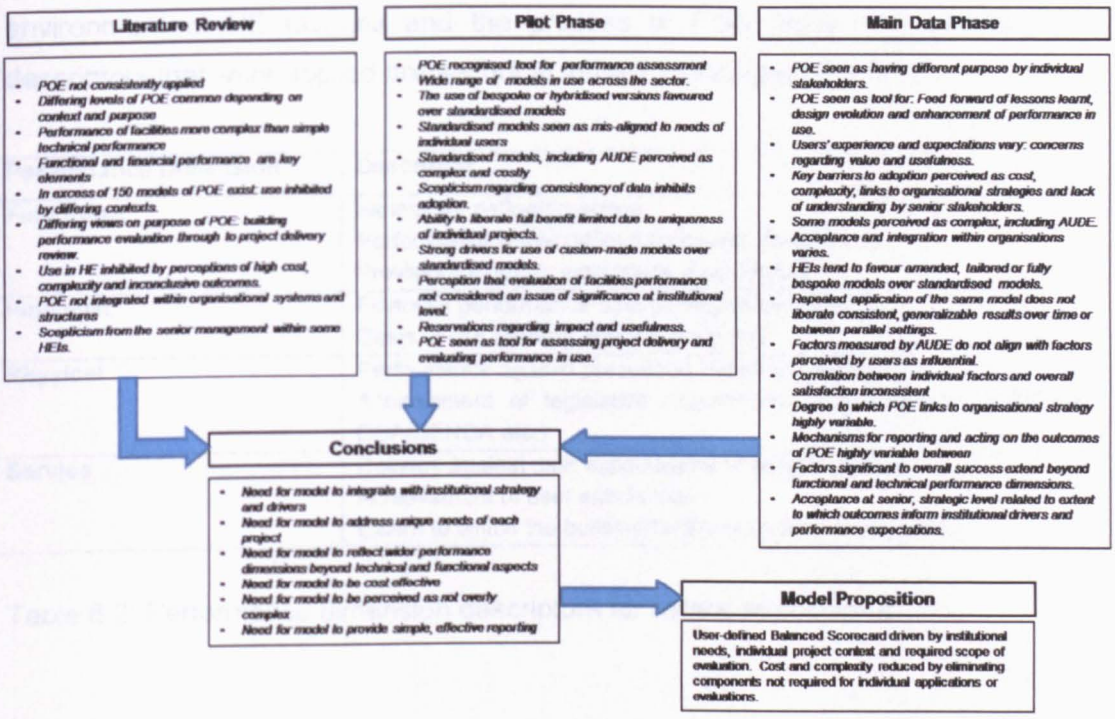

Figure 6.2: Conclusions leading to the proposition of a Balanced Scorecard

The balanced scorecard approach developed by Amaratunga and Baldry (2000) was taken as a basis for the development of the pragmatic framework for the application of POE. This model was developed for use in a much wider context of FM performance evaluation and has been adapted by the author to form the basis of a pragmatic approach to the undertaking of building or facilities performance evaluation or POE. The scorecard was enhanced and refined for use within the healthcare sector by Steinke et al (2010). The author has further refined this approach for use within the HE environment to form the basis of the proposed pragmatic POE approach.

The healthcare facilities based scorecard developed by Steinke et al (2010) comprises the four dimensions of functional performance, financial performance, physical performance and service performance. These performance dimensions were considered appropriate for translation in to the HE environment by the author, based upon the findings of the research project and the current context of HEI performance evaluation as described by Andrew (2009). They were refined by the application of descriptors to define each of the performance dimensions based upon

the needs and characteristics of the HE environment identified within the literature review and the research within the project. The descriptors that were applied seek to ensure that the four performance dimensions are focused on the specific environment of HE facilities and the process of POE within that setting. The descriptors that were applied are set out in table 6.2 and figure 6.3 below.

Performance Dimension	Descriptor
Functional	Fitness for defined purpose Performance within defined functional parameters Provision of quality work/study environment
Financial	Financial performance against targets/benchmarks. Costs in use (energy, maintenance etc)
Physical	Performance against prescribed technical standards. Achievement of legislative requirements (eg Building regulations, DDA/SENDA etc.)
Service	Delivery against user expectations of service quality Achievement of user satisfaction Extent to which the building/facility supports service quality

Table 6.2: Performance dimension descriptors for balanced scorecard

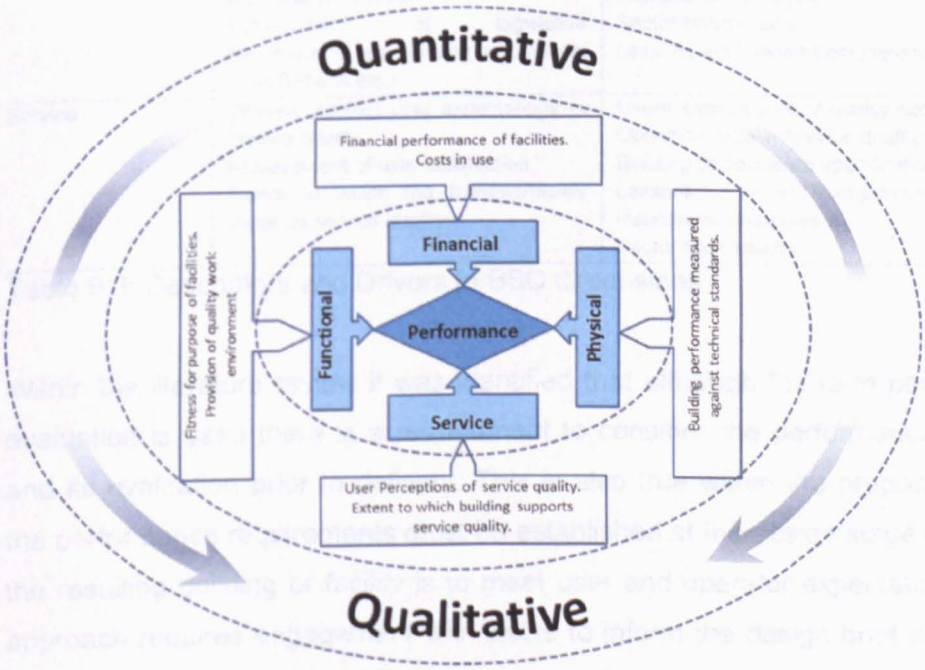

Figure 6.3: Balanced scorecard environment for HE Facilities POE

The various elements within each of the performance dimensions lean, naturally, towards qualitative or quantitative approaches to their evaluation as illustrated in figure 6.3 above. In this the financial dimension is primarily quantitative, the service dimension being primarily qualitative and the physical and functional dimensions featuring both qualitative and quantitative elements. The findings of the research indicate that there is a need for the elements to be evaluated to be specific to the individual context or project. However, there is a series of consistent inputs or drivers that inform the selection of factors to be assessed. Thus the specific elements to be assessed within any evaluation are contained within the four dimensions of the scorecard and informed by a consistent set of drivers as illustrated in table 6.3 below and figure 6.4.

Performance Dimension	**Descriptor**	**Informing Driver**
Functional	Fitness for defined purpose Performance within defined functional parameters Provision of quality work/study environment	User Expectations Facilities operators' prior knowledge Design best practice data & guidance Lessons fed forward from previous projects Institutional strategies HE sector benchmarks
Financial	Financial performance against targets/benchmarks. Costs in use (energy, maintenance etc)	Institutional strategies and targets Internal benchmarks Sector benchmarks Lessons fed forward from previous projects
Physical	Performance against prescribed technical standards. Achievement of legislative requirements (eg Building regulations, DDA/SENDA etc.)	Legislative control & standards Institutional strategies Sector benchmarks Lessons fed forward from previous projects
Service	Delivery against user expectations of service quality Achievement of user satisfaction Extent to which the building/facility supports service quality	Users' expectations of quality/service quality Operators' quality/service quality specifications Building performance specification Lessons fed forward from previous projects Institutional strategies Sector benchmarks

Table 6.3: Descriptors and Drivers to BSC dimensions

Within the literature review it was identified that although the term post-occupancy evaluation is used there is a requirement to consider the performance of a facility and its evaluation prior to delivery. This is also true within the proposed model as the performance requirements must be established at the design stage of a project if the resulting building or facility is to meet user and operator expectations. Such an approach requires engagement with users to inform the design brief as well as the BSC structure since the BSC is intended to measure performance against expectation. The inputs of users and operators within the proposed model are

illustrated along with the performance dimensions, descriptors and drivers in figure 6.4 below.

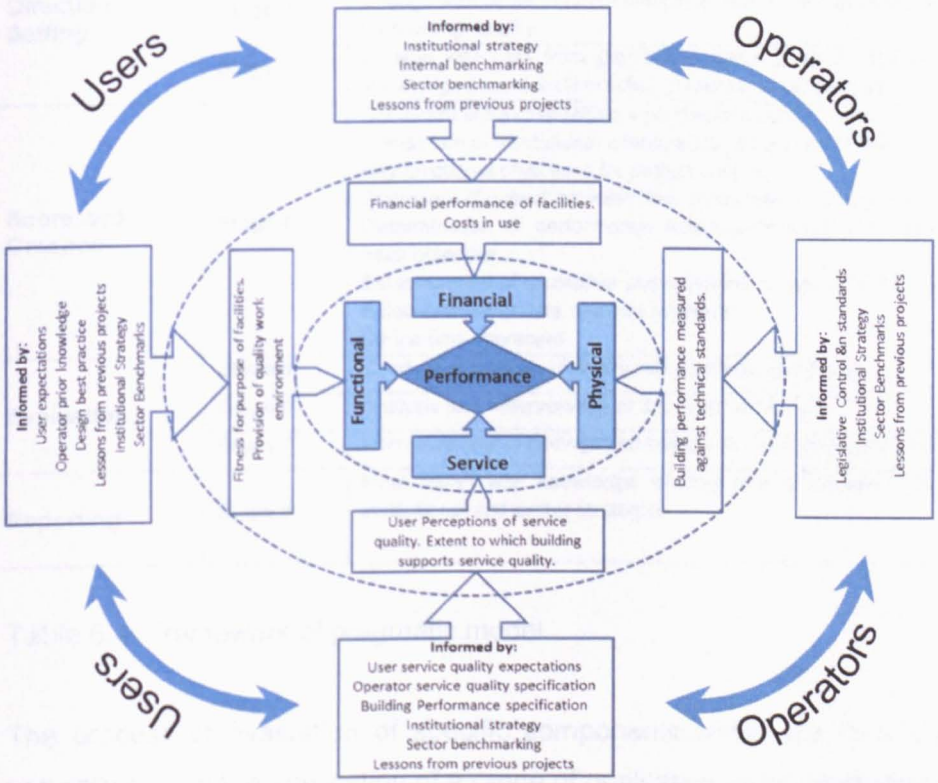

Figure 6.4: Proposed POE model; performance dimensions, descriptors and drivers

The intended implementation sequence of the proposed model is set out in table 6.4 below.

Project phase	Stage of Model	Activity
Direction Setting	Stage 1	Operators identify functional brief, challenges and goals for the project/building together with perceptions of user expectations
	Stage 2	Engage with users to refine functional brief and overarching service expectations for building/ facility.
	Stage 3	Engage with data from previous projects & review lessons learned existing knowledge base & best practice guidance to inform brief
Scorecard Creation	Stage 4	Scorecard created to reflect 4 performance dimensions and to encompass: Translation of institutional strategies to project deliverables/outcomes Key functional objectives for project/building Statement of objectives within four performance dimensions Determination of performance indicators/metrics and targets/benchmarks for each objective Establishment of qualitative and quantitative data collection methods Establishment of data analysis methods Define final scorecard
Evaluation	Stage 5	Conduct evaluation of facility using defined scorecard
	Stage 6	Analysis and interpretation of data from evaluation
	Stage 7	Internal review of findings and linkage to institutional goals and strategies
Reporting	Stage 8	Final report with knowledge sharing and presentation of findings linked to institutional and sector strategies

Table 6.4: Framework of pragmatic model

The process of evaluation of specific components within the final scorecard will naturally rely on the application of a range of qualitative and quantitative tools.

The selection of the most appropriate tool will be driven by the exact nature of the project and the factors that are selected for inclusion within the BSC. Figure 6.5 illustrates the tools available for evaluating specific factors within the BSC. The selection being driven by the specific content of the BSC in individual instances.

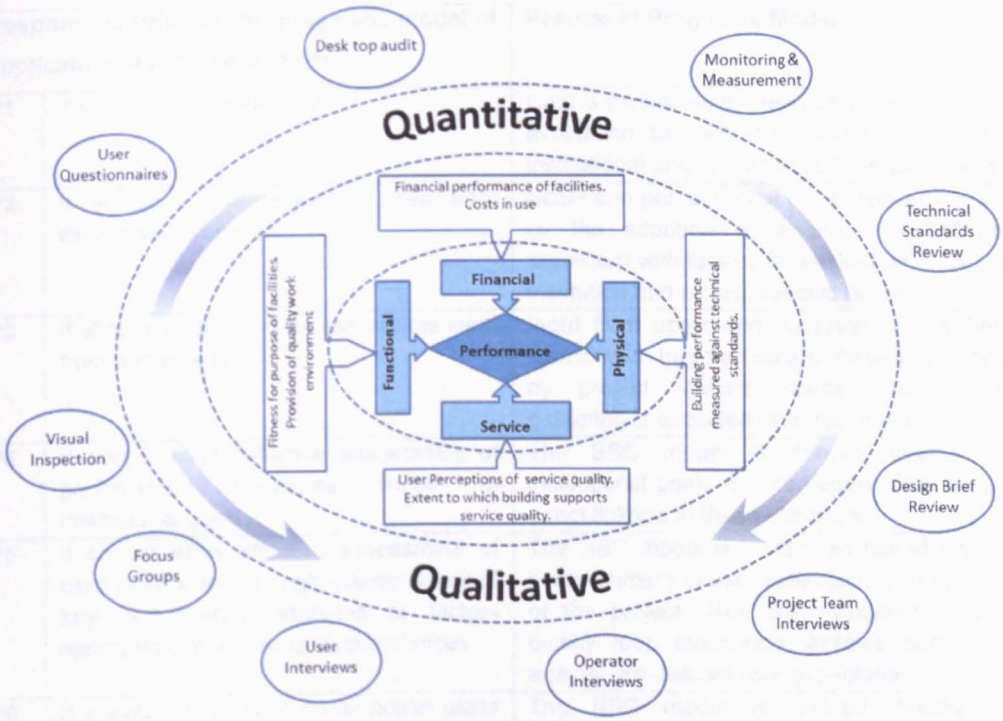

Figure 6.5: Operational components of pragmatic model

The proposed approach or 'model' has been developed from the underlying principles described earlier within this chapter. The final proposition is considered to address the defined principles as follows:

Responding Principle for pragmatic model of application of POE within HEIs		Feature of Pragmatic Model
P1	It should be cost effective	Cost is minimised by restricting the scope of the evaluation to elements derived from specific institutional and project specific requirements.
P2	It should be perceived as free from excessive complexity	Scale and perception of complexity are reduced by the adoption of a simple 4 dimension scorecard with factors for evaluation drawn from institution and project specific needs.
P3	It should not result in excessive time input from participants	Input from users and operators of facilities is restricted to targeted data gathering tools driven by project specific needs. Generic data gathering is excluded from the model.
P4	It should allow effective assessment of performance measures linked to institutional goals	The BSC model is derived directly from institutional goals and strategies, thus ensuring direct linkage to these elements
P5	It should allow effective assessment of user satisfaction through measurement of key performance attributes or factors appropriate to individual circumstances	The BSC model is composed based upon the establishment of user expectations at the outset of the project. Thus the evaluation closes a quality loop measuring facilities performance against pre-defined user expectation.
P6	It should inform institutional action plans and strategies to enhance facilities performance	The BSC model is derived directly from institutional goals and strategies, thus ensuring the ability to calibrate against institutional action plans upon completion.
P7	Lessons learned should be effectively communicated to ensure enhancement of future projects.	The BSC model is derived directly from institutional goals and strategies, thus ensuring the ability to communicate with wider institutional and sector agenda.

Table 6.5: Responding principles for POE model development and features of model

6.4 Review and evaluation of the Model

In order to validate the findings of the research and the proposed model a series of structured interviews was undertaken based around the principles defined in the foregoing sections. The participants for the validation phase were selected from the original group of Directors of Estates that were included in the main research sample. As part of the main phase of the research a quadrant analysis was used to assist in the selection of participants in the research. This process was revisited to assist in the selection of participants in the validation phase. The initial quadrant analysis identified three groups of stakeholders that had experience of the use of POE which were either unsuccessful or only partially successful. Since these three groups were most familiar of existing POE models they were used to form the basis of selection of participants in the process of validation of the proposed refined model. Six interviews were undertaken with the Directors of Estates that had experienced POE. Interviews were not conducted with those that had not

experienced POE as they did not have sufficient knowledge to allow relative assessment of the proposed model and previous models.

Structured interviews were undertaken with the selected DoEs to establish their perceptions of the proposed POE model and the principles that were established from the research project. Thus, the participants were asked to respond to the following questions:

Question 1: Do you agree with the defined principles underpinning the proposed model?

Question 2: Do you agree with the 4 defined performance dimensions contained within the model?

Question 3: Do you agree with the descriptors and informing elements to those dimensions?

More specific questions were also posed in respect of the proposed model as follows:

Question 4: To what extent do you consider that the proposed model is cost effective?

Question 5: To what extent do you consider that the proposed model is free from excessive complexity?

Question 6: To what extent do you consider that the proposed model is reduces time input from participants?

Question 7: To what extent do you consider that the proposed model allows effective assessment of performance measures linked to institutional goals?

Question 8: To what extent do you consider that the proposed model facilitates the effective communication of lessons learned to enhance future projects?

The questions that were posed during the interviews provided a framework for discussion. Unlike with the interviews conducted in the earlier phases of the project the validation interviews posed questions that were much less open. The earlier interviews incorporated a process of coding to allow the interpretation of the discussions relative to the individual questions and the broader research themes.

The earlier interviews were aimed at developing objective insight in to respondents' perceptions of the POE process. As such they were approached in a very open manner which allowed themes to emerge from the respondents without direction from the interviewer. The nature of the validation interviews was different in that the author was seeking to liberate specific responses and commentary regarding aspects of a defined proposition in the form of the proposed model. As such the interview questions were far more closed in nature. However, this approach did not preclude the interviewees from providing additional comments relating to each of the questions. The results of the interviews are summarised in the following sections.

In particular the responses to questions 2 and 3 were crucial to the refining and validation of the model. The respondents were asked to reflect upon the descriptors and informing drivers for each of the performance dimensions and to comment upon their appropriateness or relevance to the context of their specific needs. They were invited to present alternative or refined descriptors and informing drivers based on their own perceptions of the desired factors to be evaluated within the model. The outcomes of this exercise, which are described in detail below were used to refine the proposed model.

Question 1: Do you agree with the defined principles underpinning the proposed model?

There was a consistent view amongst all six interviewees that the proposed principles underpinning the development of the model were appropriate. All six interviewees agreed with the barriers that had been identified and the proposed responding principles. There was very strong agreement in all four interviews with the principles of cost and complexity reduction and the views of these as potential barriers to adoption of POE were reinforced from the earlier interviews. None of the interviewees considered the proposed principles to be inappropriate

Question 2: Do you agree with the 4 defined performance dimensions contained within the model?

All six of the interview participants agreed with the defined performance dimensions. However, there were differing views in relation to the exact terminology associated with the dimensions.

One of the respondents expressed the view that the term 'sustainability' should be incorporated within each of the dimensions. This would result in the use of the terms Financial Sustainability, Physical Sustainability, Functional Sustainability and Service Sustainability rather than the proposed terms Financial, Physical, Functional and Service for each of the dimensions. Considerable discussion took place around this point, which resulted in the consensus that the issue of sustainability should be added to the model within the descriptors to each of the performance dimensions. As a result the model was refined to incorporate this element.

A further issue that arose was linked to the underlying purpose of the POE process. The literature review and the empirical work indicated that there is a division in perception amongst those using POE regarding its exact purpose and focus. The main body of opinion sees POE as a process for evaluating the performance of buildings and facilities in use. However, there is also a view that the process should be used to evaluate the process of project delivery and the performance of project teams. This was reflected during the validation interviews with one respondent seeking to add a fifth performance dimension to the scorecard to reflect project delivery. Considerable discussion took place around this issue, which resulted in two very clear concepts being identified as being critical to the evaluation of performance associated with project delivery or project success. Firstly it was identified that the degree to which the final project reflected the initial design and procurement brief was a critical factor. Secondly the financial out-turn of the project was identified as a critical factor. Both the details of the design brief and the financial factors associated with operation of the facility feature within the proposed model in the context of the performance of the facility in use. However, the detailed aspects of these associated with project delivery are not identified specifically.

Two approaches to resolving this concern were considered and presented to the other interviewees for comment. Firstly there was the option of introducing a fifth dimension to the scorecard associated with 'delivery'. Secondly there was the option

of introducing descriptors in to the existing four dimensions that could cater for the issues around project delivery. There was concern on the part of all interviewees that the introduction of a fifth dimension might introduce extra complexity to the proposed model. In addition it was considered that the process of project review was not necessarily a required feature in all instances of POE and that the extra dimension may be effectively redundant in many cases. As a result of these concerns the agreed approach was to introduce descriptors to each of the existing, proposed dimensions that could cater for project review criteria when necessary within the proposed framework.

The most significant reservation expressed by those interviewed surrounded the use of the term 'Service Dimension'. This term was derived from pre-existing scorecard models associated with commercial organisations and, in particular, healthcare. Significant discussions took place with the interview respondents surrounding the concept of service delivery within Higher Education. There were differing views in this regard. All of the interviewees identified an increasingly important role for facilities and buildings in presenting an attractive environment to support recruitment and retention of students. However, three of the respondent also cited institutional reluctance to fully embrace the concept of HEIs as providers of what might be considered 'customer service' in a commercial sense. There was a perception amongst all respondents that the use of the term 'service' might result in an approach based entirely on consumer expectation, without taking in to account other drivers of service quality such as academic enhancement, quality assurance and so on. The author was receptive to this viewpoint and in discussion with the interview participants it was agreed to replace the term 'service' with the term 'experience' as this might be considered to be less consumerist in its approach. Accordingly the labelling of this performance dimension was amended in the refined model as indicated below.

Proposed Performance Dimension	Agreed Performance Dimension
Functional	Functional
Financial	Financial
Physical	Physical
Service	Experience

Table 6.6: Refined Performance Dimension labels

Question 3: Do you agree with the descriptors and informing elements to those dimensions?

To a large extent the responses to this question overlapped with those to the previous question as the descriptors were amended to ensure that the four defined performance dimension were appropriate. The descriptors were largely accepted in their initial, proposed form with the exceptions of those elements discussed in the context of the previous question.

During the course of the validation interviews the descriptors adopted within the model were considered in detail and the views of individual participants noted. In order to ensure a robust approach to the evolution of the descriptors the author sought to establish a consensus view amongst all of the participants. The approach that was taken was to gather comments relating to the descriptors from each of the participants and to circulate these to all of the other interviewees for discussion and comment. On this basis the amendments were evolved through an iterative process to reach consensus, which resulted in several of the participants revising their original views modestly. Where comments from individuals were unsupported by a consensus view they were noted but discarded in terms of amending the descriptors.

One of the key areas that arose from this process was the increased focus upon sustainability. The participants were relatively consistent in their views on this area and there was clear consensus that sustainability was seen as a crucial, core element in evaluating performance. The comments from the interviewees also indicated, strongly, that there was an appreciation of the concept of sustainability in the wider context rather than being constrained to environmental sustainability. As such the descriptors were amended to reflect financial and organisational sustainability, Corporate Social Responsibility and environmental performance. The extent to which sustainability featured within the individual interviews was significant and there was a clear and consistent view that HEIs have recognised the its wider context in development, delivery and operation of facilities.

The issue of sustainability was introduced in to the descriptors for all four of the service dimensions to reflect the on-going nature of the performance of facilities rather than representing a snap-shot of performance evaluation. In addition the introduction of factors associated with project delivery was undertaken to reflect the

potential requirement for pure POE to incorporate aspects of post-project review. The amendment of the label of the 'Service' dimension to the label of 'Experience' also required slight refining of the descriptors associated with it. These three elements resulted in the introduction of the following additional descriptors (in red) to the initial proposed descriptors.

Performance Dimension	Initial Proposed Descriptor	Final Agreed Descriptor
Functional	Fitness for defined purpose Performance within defined functional parameters Provision of quality work/study environment	Fitness for defined purpose Performance within defined functional parameters Provision of quality work/study environment Sustainable use through flexibility in form Project delivery of functional aspects benchmarked against initial design brief.
Financial	Financial performance against targets/benchmarks. Costs in use (energy, maintenance etc)	Financial performance against targets/benchmarks. Costs in use (energy, maintenance etc) Financial sustainability and life cycle costs Financial performance against project delivery targets (eg out-turn costs) Return on investment
Physical	Performance against prescribed technical standards. Achievement of legislative requirements (eg Building regulations, DDA/SENDA etc.)	Performance against prescribed technical standards. Achievement of legislative requirements (eg Building regulations, DDA/SENDA etc.) Performance against sustainability KPIs (eg Carbon reduction) Project delivery of physical aspects benchmarked against initial design brief.
Experience (formerly Service	Delivery against user expectations of service quality Achievement of user satisfaction Extent to which the building/facility supports service quality	Delivery of service against user expectations of quality of experience Achievement of user satisfaction Extent to which the building/facility supports quality of user experience Sustainability of service delivery against evolving user expectations Corporate Social Responsibility targets

Table 6.7: Refined Performance Dimension descriptors

Question 4: To what extent do you consider that the proposed model is cost effective?

The interview participants expressed a variety of opinion relating to the cost effectiveness of the proposed model. All six interviewees welcomed the opportunity to apply a simple model that could be put in to practice in an economical manner. One of the respondents expressed the strong view that there was a clear benefit in applying only the bare minimum of tools within a POE process and that cost minimisation was a strong driver. He went further to state that the proposed model offered a potential solution to allow the identification of these minimum components in a structured way. The remaining respondents were more guarded about the issue

of cost reduction. All referred to value for money rather than absolute cost minimisation. In this context they were receptive to the concept of the scorecard approach as it was considered to offer a mechanism for selecting appropriate, targeted POE tools and techniques to address their pre-defined needs for individual projects. It was also noted by three of the interviewees that the perceptions of cost and value of the POE process would be heavily influenced by the extent to which the process liberated tangible benefits. This factor was noted to be at least as important as the issue of absolute costs associated with developing and applying the scorecard.

Comments relating to cost reduction of the process included the following:

> The proposed model could be extremely cost effective if the development of the details of the scorecard is approached in a properly structured way

> there would be much to gain by developing a simple model that was not resource intensive, anything that assists with that is likely to be welcomed by the sector.

> Identifying the appropriate drivers and providing robust analysis would build confidence and hopefully allow organisations to derive tangible benefits from the process. Many organisations may undertake a POE through necessity (satisfy audit requirements) rather than undertaking the process as best practice. If the POE is fully utilised it will inform future organisational strategy. These issues have to be reflected when considering the cost of the POE process.

Question 5: To what extent do you consider that the proposed model is free from excessive complexity?

All of the interview participants expressed strong support of the aspiration to reduce complexity in the POE process. Although those interviewed had varying degrees of experience in terms of different existing POE models they all expressed the view that complex questionnaires and expansive POE models were undesirable. A key factor in this context was cited to be the extent to which a POE model could be developed and applied that was sufficiently robust in its approach to liberate detailed, meaningful data. At the same time it was required that it must be sufficiently bespoke in its focus to allow such data to be gathered about a specific project without encompassing excessive generic aspects. It was recognised that some existing models are overly sophisticated and expansive as a result of attempting to capture all potentially useful data for all potential scenarios. The adoption of a scorecard that can be refined at the outset of each individual project

was agreed by all four interviewees as a workable mechanism for refining the content and context of individual POEs.

Comments made included the following:

> The proposed model would simplify in many cases an existing complex processes as it doesn't try to capture every possible piece of detailed data about every possible building project. This appears to allow a far more targeted approach to data gathering and analysis

> Identifying the key drivers and reducing the volume of questions is essential. Moreover, the proposed model provides clarity and gives clear structure to the objective of the process.

Question 6: To what extent do you consider that the proposed model is reduces time input from participants?

The responses to this question overlapped significantly with those of the previous question. Four of the interviewees cited lack of engagement with the POE process by end users and stakeholders as a key inhibitor to its effective adoption within HEIs. Two of the respondents had utilised the AUDE POE toolkit with limited success. In both cases the process was considered to be restricted in its value due to the poor response rates to the questionnaires contained within the model. One of the interviewees had also utilised the DQI model, which incorporates in excess of 100 questions within the questionnaire. These factors were considered to be impactful upon the willingness of building users to complete the questionnaires and to engage with the process. In addition all six respondents expressed the wish for the process of undertaking the POE, analysing the results and developing reports to be less time consuming. Once again, this issue was linked strongly, in terms of perceived value, to the extent to which tangible benefits are liberated from the process. All participants agreed that higher levels of time input would be accepted if the outputs of the process were meaningful and beneficial to the institution. There was a general consensus that the targeting of factors to be evaluated at the outset of an individual project would reduce superfluous content and allow more time effective delivery of POE.

Comments made included the following:

> The proposed model substantially simplifies the volume of questions required to ascertain accurate data for individual projects; this has to be a good thing

> A reduction in questions will reduce the time commitment required by a participant. The result should be an increase in participants returning questionnaires and completing the process. This is currently one of the biggest flaws in the application of existing POE approaches
>
> The more participation by key stakeholders the more confidence in the findings. This process would get the user to identify and concentrate on a small group of key themes and obtain data more effectively

Question 7: To what extent do you consider that the proposed model allows effective assessment of performance measures linked to institutional goals?

This question liberated some of the most energetic responses to the proposed model amongst the interview sample. In four of the six interviews there was a very strong viewpoint that existing POE applications within HEIs are not linked in a meaningful way with wider institutional goals and strategies. In one instance the view was expressed that POE was not valued at an institutional level in any way and that it was considered to be a tool limited to the physical measurement of building operations in abstract of the context of buildings within a wider institutional setting. However, in one instance there was a perception of clear, existing linkages between institutional strategies and the role of buildings and facilities within them being evaluated in a useful way through POE.

All six of those interviewed considered the inclusion of the financial performance dimension within the scorecard model to be a key factors in linking POE to wider institutional goals and strategies. There was, however, a view expressed by one participant that the effective application of the proposed model required the engagement with stakeholders at a senior level within the HEI. They went further to suggest that if such engagement could not be guaranteed it could undermine the model. This point was noted by the author.

Comments made included the following:

> If the four criteria (Functional, Financial, Physical, Service) were correctly identified and linked to the organisations key objectives the proposed model would be an effective method of assessing performance.
>
> If you take the basic concept of the balance scorecard it is designed to transform strategies into action. The proposed model would accomplish this objective by providing the basis for developing a strategic framework.

The proposed model would provide a co-ordination system which would allow the user to identify suitable goals and objectives. By developing a series of distinct and recurring strategic themes and measuring the inputs it would allow effective assessment of user satisfaction that could then be transferred into a series of strategically focused actions.

These actions would be used to inform the organisations action plan/strategy which in-turn would be developed into suitable structures in order to organise future outputs/projects, etc

Question 8: To what extent do you consider that the proposed model facilitates the effective communication of lessons learned to enhance future projects.

This question liberated interesting results in that all six of the respondents indicated, in different ways, that they considered the issue of feed forward of lessons learnt to be more about the positioning of the POE process than about its form or content. All indicated that the process of informing future projects relied upon the data from the POE process being well defined and meaningful. In this context all interviewees referred to the specific nature of individual projects and the potentially generic nature of data gleaned from POEs. Five of the six interviewees were positive in their perceptions of the potential for identifying and feeding through lessons regarding the delivery of projects and the performance of resulting facilities.

The remaining respondent was sceptical about the extent to which institutional senior management would react to the outcomes of the POE process in a way that allowed them to influence future projects. This response was presented by the same interviewee that had expressed concerns regarding the extent to which stakeholders within the senior management of HEIs might be willing to engage with the whole process of facilities performance enhancement and POE. Extensive discussions were undertaken with this respondent and with the other respondents which suggested that this was a particular issue with one institution. However, it was accepted that the issues raised did highlight the importance of meaningful outcomes being derived from POE that could liberate tangible benefits in terms of building performance and institutional strategies.

All of the respondents indicated that the proposed model offered the opportunity to link both project goals and the scope of POE to such institutional goals in a direct way through the pre-project development of the scorecard. In this sense they were all generally supportive of the proposed approach.

Comments made included the following:

> By identifying the key outputs from the outset, simplifying the process, developing robust data and building confidence in the results, the proposed model will substantially improve communications.
>
> Key stakeholders should fully understand the process and appreciate how it links to the organisations objectives and have confidence in the findings. The data/results would allow recipients of the data to make informed decisions on future development strategies.
>
> If we can't learn fruitfully from one project to the next the purpose of POE is really subject to question.
>
> The idea of a case by case scorecard allows us to input the key themes that are important to the university in to each POE is some sort of managed way. This should mean that we are actually looking for the right things from the outset and feeding these in to future works instead of just gathering random information and hoping it somehow links from one building to the next.

6.5 Summary

The process of the validation interviews resulted in slight refining of the proposed model. However, the main components and the broad approach was accepted by the Directors of Estates as having merit in applying POE in a pragmatic and meaningful way within HEIs. It is clear that the level of institutional support given to the process is significant in terms of its ultimate success in acting as a tool for facilities performance enhancement. This in turn, relies on the demonstration that the process liberates meaningful outcomes that can be linked to on-going institutional agenda and input in to future projects in such a way as to effect some tangible benefit. The process of undertaking interviews to consider and validate the proposed model has been useful and informative. In broad terms the model is validated as being fit for purpose by the Directors of Estates as key stakeholders and their input has resulted in positive refining of the model to position it as a pragmatic and useable POE technique within the selected setting of Higher Education institutions in England and Wales.

The resultant model is illustrated in figure 6.6 below.

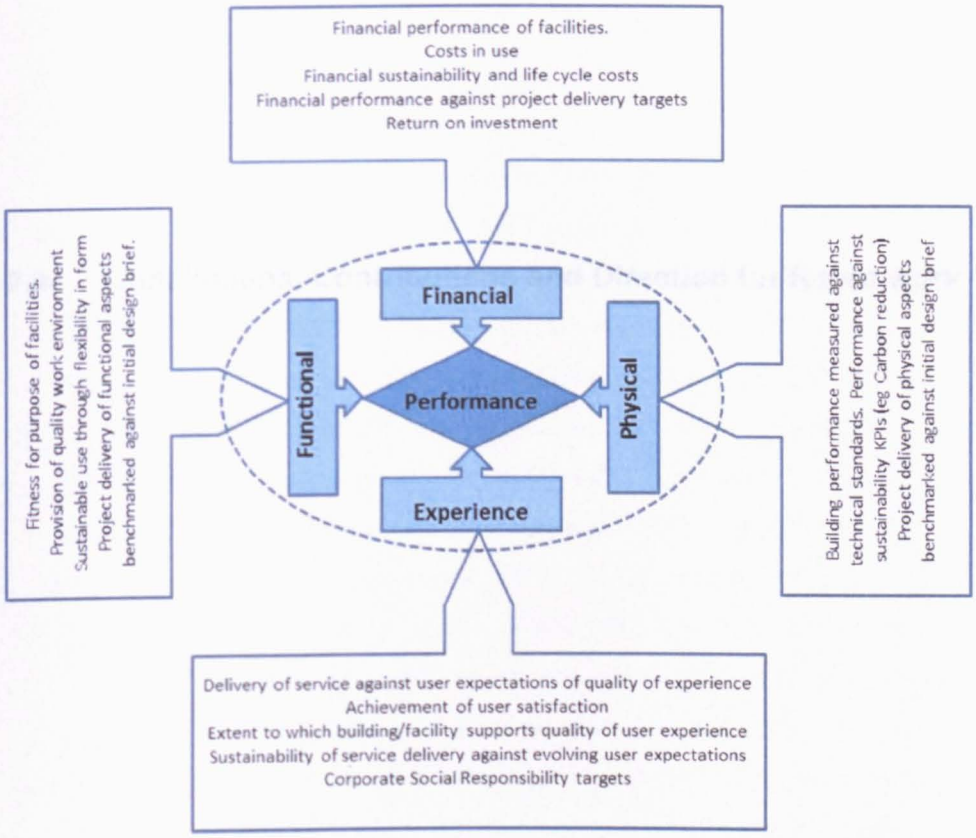

Figure 6.6: Refined Model for POE

7.0 Conclusions, Contributions and Direction for future work

7.1 Introduction

This chapter sets out the overall findings of the research in relation to the aims and objectives that were articulated at the outset of the project. These are described within Chapter 1 of this thesis but for the purpose of clarity they are repeated within this chapter. In order to address the research aims and objectives the project incorporated a rigorous and systematic review of existing literature, the findings of which informed the structure and content of the empirical parts of the work. The literature review, which is presented in Chapter 2, allowed the identification of key areas of existing knowledge and the definition of areas requiring further research within the project through extensive data collection, analysis and interpretation. A structured approach to the selection of available research approaches was taken, based on the identified aims and research context. This is described within chapter 3 and resulted in the adoption of a mixed methods approach. The literature review and methodological review were followed by the undertaking of a pilot phase, which is presented in Chapter 4. The pilot phase incorporated questionnaires and interviews with Directors of Estates to allow the validation of the literature review findings and the formulation of the final approach to the main data collection phase. The main part of the study is presented in Chapter 5 and utilised both qualitative elements in the form of interviews and focus groups and quantitative elements in the form of questionnaires. The findings of the literature review, the pilot phase and the main phase of the research were reviewed, interpreted and triangulated within Chapter 6 to allow the presentation of composite findings. These findings were then used to inform the development of a set of principles that were defined to support the proposition of a revised, scorecard approach to POE within HEIs. The model that was proposed was then validated through a series of structured interviews with Directors of Estates.

This chapter now presents a summary of the research findings in relation to each of the previously stated aims and objectives. In addition it outlines the contribution to theoretical and practice based knowledge resulting from the project. It then concludes with consideration of the limitations of the study and provides suggestions for the possible direction of future work in areas that have emerged from this research.

7.2 Research Summary

The aims of this research were to evaluate the effectiveness of existing POE models within the Higher Education sector in enhancing building and facilities performance, to establish the extent to which they assess the factors that influence user satisfaction and to propose a revised model that addresses the needs of individual Higher Education institutions.

The achievement of these aims was effected through a series of defined research objectives which have been reflected in the detailed phases of the study in considering the main research hypothesis.

The first research objective was: *To identify existing models of POE and the basis upon which they have been developed and applied*

The second research objective was: *To establish the generic drivers and inhibitors for the application of POE and to compare and contrast these to the specific drivers and inhibitors in the context of HEIs.*

The third research objective was: *To identify the nature of outcomes of POE applications in differing scenarios and contexts.*

The fourth research objective was: *To identify the key desired outcomes of POE in the specific context of HEIs.*

The fifth research objective was: *To gather and evaluate data in order to assess perceptions of the applicability and efficacy of different models of POE and to link and compare these to the application of the POE process HEIs.*

The sixth research objective was: *To propose a pragmatic model for the application of POE aimed at delivering the desired outcomes within the specific research context.*

The study found that there are numerous POE models in existence internationally, with more than 50 in common use within the UK. The development and application of the various models has been driven by a wide range of factors including the desire to develop robust design data, to learn lessons from projects that can be fed forward to improve the design and delivery of facilities and to enhance the

performance of buildings and facilities in use. The features of the various models differ depending upon context and purpose, however, they all feature components of qualitative or quantitative data collection to allow analysis relative to performance requirements or perceived benchmarks. The element of user satisfaction features within some models but this is not exclusively the case. However, the notion that a consistent set of performance factors can be replicated within different, individual circumstances features in many of the models. This is to an extent the case with the AUDE model that is favoured by the Higher Education Funding Council for England. The AUDE model is aimed specifically at the Higher Education sector and features a range of possible component parts from which users can assemble suitable POE solutions for their needs. Whilst this and similar models are widely adopted there is an inconsistent application across the UK HE sector both in terms of the models adopted and the perceived purpose of POE as a process. There is also variable satisfaction with the outcomes of the POE process.

As a result many HE institutions do not adopt the well-developed AUDE model, preferring to develop fully bespoke, or highly amended versions of standard POE solutions that are deemed suitable for their specific institutional needs. Several of these were identified during the research, with differing structures and levels of complexity depending upon their purpose and upon the degree to which the value of POE is recognised within individual HEIs. The resistance to existing, structured POE models is associated with a range of factors that were identified during the study. Perceived complexity and excessive cost of application were two of the most significant barriers to adoption. In addition there was evidence of lack of recognition of the POE process at senior levels within HEIs as a valid tool to assist in delivery of key institutional goals beyond the simplistic view of the process at an operational building management level. This lack of institutional value appears to be linked to lack of visible connectivity of the process building performance evaluation to the institutional strategies and plans for which the physical environment is an enabler. This situation is exacerbated in some institutions as a result of the scepticism of some Directors of Estates and senior managers within institutions of the value and usefulness of the data liberated by the POE process. The view of the process as a means to satisfy audit requirements or static reporting processes rather than as an on-going tool for enhancing facilities design, delivery and operation relegates the process to an archive function in some cases.

The potential value of the process was recognised within the HE sector although the majority of institutions regarded its primary purpose to be the harvesting of lessons

learnt from individual projects to feed in to future projects. As such much of the data gathered is aimed at improving design and procurement procedures rather than identifying and rectifying factors that affect user satisfaction. The ability to enhance performance of facilities was seen primarily in the context of technical or physical performance, in which the factors or attributes are readily measurable and manageable.

However, the study revealed that physical and internal environmental factors, whilst influencing user satisfaction, did so in varying patterns and with varying levels of impact in differing situations. The perception of quality, however, consistently correlated with users' overall perceptions of satisfaction with buildings. The study also revealed that the term 'quality' is a construct of individual factors that appear to be strongly associated with perceived quality of construction, fixtures and fittings. It was recognised that further work could be developed to allow the underlying factors within the quality construct to be fully defined.

The research concluded that the development of a single template POE model would be inappropriate for the reasons state above. Hence, the framework that has been proposed builds upon earlier work within the Canadian health sector with the use of a building performance evaluation scorecard. The use of the scorecard approach reflects the importance of four performance dimensions that are tailored to the specific context of UK HE. This model allows the linkage of POE to strategic institutional plans and goals and the selection of specific scorecard elements for each application of the process. As a result it supports institutions in developing targeted POE solutions in a cost effective manner without undue complexity and in a manner that is fit for purpose.

7.3 Research Contributions

The research that has formed the basis of this project has liberated a deal of data and has resulted in the development of several key elements of original contribution to knowledge. The author believes that contributions have been made to both theoretical knowledge and professional practice.

7.3.1 Theoretical contribution

From a theoretical perspective the research established that within the context of Higher Education institutions the concept of a consistent set of factors that correlate with overall user satisfaction is flawed. The empirical work indicated that the construct of 'quality' is linked to perceptions of satisfaction in a consistent manner. The construct of 'quality' itself is made up from a set of physical, functional and service related factors that vary from context to context. The physical elements within this construct feature consistently in users' perceptions of overall satisfaction. The notion that a consistent and generalisable wider set of satisfaction factors was proven to be inappropriate. However, the research indicated such some satisfaction factors, including features of internal environmental quality, spatial configuration and functional performance attributes, do influence overall satisfaction in individual applications of POE. The perception on the part of building users of their ability to effect local control of the internal environmental, most notably thermal comfort is a strong feature in perception of overall satisfaction.

It was also established that the repeated application of the same POE model within a single setting liberates different results regarding overall satisfaction. Perceptions of defined physical and environmental factors within consistent HE building settings vary over time as a result of influences that are not measured within existing POE models. Thus, a further contribution to theoretical knowledge is the finding that user satisfaction is a construct of a varying set of individual factors and that the assembly of those factors is a time related variable.

The research also indicated that the nature of the application of POE is inconsistent across the HE sector. The purpose of the process differs between institutions and between individual applications within institutions, with varying degrees of connectivity to institutional objectives and strategies.

These findings indicate that the development and adoption of standardised or template POE models within a Higher Education setting is unlikely to liberate consistent and useable data to enhance building and facilities performance.

7.3.2 Contribution to Practice

The findings of the research liberate valuable information for operators of Higher Education estates in their pursuit of delivering and managing facilities that address the needs of users and the requirements of strategic institutional goals. The model that has been proposed supports operators of Higher Education facilities in targeting and evaluating the factors that are significant to facilities performance in specific instances. The identification of the individual elements of each of the performance dimensions within the scorecard model allows institutions to target evaluations for specific circumstances and specific settings. The recognition that the use of complex questionnaires to measure numerous factors associated with satisfaction is inconsistent allows users of POE to reduce complexity and move away from such approaches in favour of tailored evaluations. The adaptation of the scorecard approach that has been used in the different context of healthcare facilities supports institutions in the cost effective development of tailored POE solutions.

In addition the introduction of elements that are derived from institutional strategies, such as the financial performance dimension create stronger connections to the wider institutional goals. This, in turn, enhances the value of the POE process to the institution as a whole, rather than the estates function in isolation.

7.4 Limitations of the Study

Whilst recognising the benefits of the research and the contribution to knowledge that it makes it is also essential to acknowledge the limitations of the study. To some extent certain of these limitations have been discussed in earlier parts of the work including chapters 3, 4 and 5.

In particular the potential limitations associated with the sample selection and participation were considered within both the pilot phase and the main phase of the research. Whilst a rigorous approach was taken to the selection of interview subjects from the potential population of HEI Directors of Estates, it is recognised that only around 30% of the potential population responded to the initial landscaping questionnaire, this restricting the extent to which the findings can be considered entirely representative of the HE sector

The limitations associated with sample selection and participation were also noted in respect of the user groups that completed the AUDE questionnaires. The questionnaire was made available to all building users through the Bristol on-line system for a period of one month in each of the instances of the survey. Whilst users were invited by email to participate in the survey, they did so-on an entirely voluntary basis. The author did not restrict or filter the participant groups, which varied in terms of proportional make-up and sample size between instances of the survey. As such the proportions of user types within each of the survey samples was variable, particularly in the case of the 2013 application of the survey in the Tom Reilly building with very few student respondents. The number of survey respondents also varied between instances of the surveys with samples ranging from 40 to 95 participants. It is recognised that larger sample groups would increase the reliability and validity of the findings.

Some of the potential limitations associated with the research approaches taken were considered during the research and measures were taken to reduce their potential impact. In particular the use of a pilot phase to test the interview scope and content allowed refining of the interview structure to aid consistency. The conducting of the focus groups by an independent facilitator was aimed at minimising the potential for bias within this element of the work.

Some of these limitations have the potential to limit the generalisability of the outcomes of the work. However, they did not significantly hinder the research process or the ability to develop conclusions based upon the interpretation of the results of data analysis. There is however a series of caveats that should be applied in considering the conclusions of the work.

The research has been conducted, primarily, in the context of a single HEI although it has featured two discrete research settings. Without further study in a wider range of research settings it is not possible to state categorically that the research conclusions will be valid within all HEIs. The utilisation of two buildings within the same geographical region and, indeed, the same HEI may be seen as a potential limitation of the generalizability of the results. However, their selection does ensure that the potential variability associated with location is controlled to a degree. The use of two or more buildings that are located in different regions would add an additional uncontrolled variable to the study. Further work would, ideally roll out the

study to more geographically dispersed locations to allow wider conclusions to be drawn.

The research has also been undertaken at a point in time at which the Higher Education sector is experiencing rapid change. This is reflected in changing users expectations and evolving institutional and sector drivers and performance indicators. The generalisation of the outcomes of the study may be heavily influenced by the features of the rapidly changing Higher Education environment within a relatively short period of time.

7.5 Direction of future research

One of the main findings of the work was that the adoption of a standard or template POE model does not liberate consistent outcomes within the HE environment. This resulted in the proposition of a framework based upon the balanced scorecard approach to allow the development of custom approaches for individual settings based on a consistent set of drivers and performance dimensions. However, although this approach has been validated through structured interviews with Directors of Estates limitations in terms of time and resources have prevented its testing in practice. The author believes that the application practice, within a variety of Higher Education scenarios should be a future aspiration in order to test and refine the model. The application of the work within a larger sample would enable clearer and more robust conclusions to be drawn from the work. This should set the impetus for future work to develop a robust and agile model for the application of POE within a variety of Higher Education settings and beyond.

A further key finding of the study was the identification of the influence of perceived 'quality' upon overall satisfaction, both in terms of physical building quality and in terms of perceived service quality. Further work should be undertaken to identify the underpinning factors that make up the overall construct of quality from the perspectives of both building operators and building users. This aligns with the need to establish better defined factors within the 'service' performance dimension to allow facilities operators to deliver buildings that effectively meet user expectations and performance demands.

As a result of the project four of the Directors of Estates that participated have requested that the proposed model be utilised within their institutions.

Findings of some of this research work have been peer reviewed and published in the following forms:

Riley M. and Cotgrave A. (2013) *Post-occupancy Evaluation as a tool for performance enhancement.* RICS Cobra Conference, Delhi, India

Riley M (2011) *Facilities & Maintenance Management Best Practice; Lessons to Learn'* in Facilities and Maintenance Management *Ed Nizam S.*, Prentice-Hall, Malaysia. (Publication pending)

Riley M., Kokkarinen N., Pitt, M. (2010). *Assessing post occupancy evaluation in Higher Education Facilities.* Journal of Facilities Management Vol. 8 (3)

Riley M., (2008); *Facilities & Maintenance Management Best Practice: Lessons to Learn*, National Seminar on Facilities & Maintenance Management In the 21st Century: The Demand & Needs for Growth In Malaysian Building Industry Kuala Lumpur, Malaysia

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Appendix 1

Buildings within the Research Setting

TOM REILLY BUILDING

Plate 1: Tom Reilly Building External View

Plate 2: Tom Reilly Building Side Elevation

Overview of Main Accommodation: Tom Reilly Building

Construction Date:	**2009**
Gross Floor Area:	**6493 sq M**
General Arrangement:	**5 Floors**
Construction Form:	**In-situ Concrete Frame, Brick and panel cladding**
Occupancy:	**Sport & Exercise Sciences and Natural Sciences and Psychology**
Student Numbers:	**1557**

Accommodation Schedule

Room No	Room Area m^2	Room Use
1st floor		
1.02	11.68	ACADEMIC STAFF OFFICE
1.03	11.76	ACADEMIC STAFF OFFICE
1.04	11.78	ACADEMIC STAFF OFFICE
1.05	11.78	ACADEMIC STAFF OFFICE
1.06	11.78	ACADEMIC STAFF OFFICE
1.07	11.82	ACADEMIC STAFF OFFICE
1.08	11.08	ACADEMIC STAFF OFFICE
1.09	11.1	ACADEMIC STAFF OFFICE
1.1	11.56	ACADEMIC STAFF OFFICE
1.11	12.08	ACADEMIC STAFF OFFICE
1.12	42.29	ACADEMIC STAFF OFFICE
1.14	8.96	ACADEMIC STAFF OFFICE
1.15	8.96	ACADEMIC STAFF OFFICE
1.16	10.14	ACADEMIC STAFF OFFICE
1.17	10.14	ACADEMIC STAFF OFFICE
1.18	10.14	ACADEMIC STAFF OFFICE
1.19	10.14	ACADEMIC STAFF OFFICE
1.2	8.96	ACADEMIC STAFF OFFICE
1.21	8.96	ACADEMIC STAFF OFFICE
1.22	11.98	ACADEMIC STAFF OFFICE
1.23	11.53	ACADEMIC STAFF OFFICE
1.24	12.16	ACADEMIC STAFF OFFICE
1.25	8.96	ACADEMIC STAFF OFFICE
1.26	10.12	ACADEMIC STAFF OFFICE
1.27	10.12	ACADEMIC STAFF OFFICE
1.28	10.12	ACADEMIC STAFF OFFICE
1.29	20.6	ACADEMIC STAFF OFFICE
1.3	9.99	ACADEMIC STAFF OFFICE
1.31	10.09	ACADEMIC STAFF OFFICE
1.32	10.1	ACADEMIC STAFF OFFICE
1.33	10.09	ACADEMIC STAFF OFFICE
1.34	10.1	ACADEMIC STAFF OFFICE
1.35	10.1	ACADEMIC STAFF OFFICE
1.36	10.08	ACADEMIC STAFF OFFICE
1.37	10.09	ACADEMIC STAFF OFFICE
1.01	43.09	FACULTY OFFICE
1.13	36.14	POST GRADUATE OFFICE OFFICE

2nd Floor		
2.25	12.16	ACADEMIC STAFF OFFICE
2.26	8.96	ACADEMIC STAFF OFFICE
2.27	10.12	ACADEMIC STAFF OFFICE
2.28	10.12	ACADEMIC STAFF OFFICE
2.29	10.12	ACADEMIC STAFF OFFICE
2.3	21.39	ACADEMIC STAFF OFFICE
2.03	7.75	LABORATORY
2.04	7.75	LABORATORY
2.05	7.68	LABORATORY
2.06	7.62	LABORATORY
2.07	11.78	LABORATORY
2.08	11.82	LABORATORY
2.09	11.09	LABORATORY
2.11	31.52	LABORATORY
2.12	42.34	LABORATORY
2.12A	6.51	LABORATORY
2.12B	7.28	LABORATORY
2.12C	7.28	LABORATORY
2.12D	6.77	LABORATORY
2.13	8.29	LABORATORY
2.14	7.94	LABORATORY
2.15	7.94	LABORATORY
2.16	7.94	LABORATORY
2.17	6.08	LABORATORY
2.18	6.08	LABORATORY
2.19	7.94	LABORATORY
2.2	7.94	LABORATORY
2.21	7.94	LABORATORY
2.22	8.29	LABORATORY
2.23	6.92	LABORATORY
2.24	24.11	LABORATORY

3rd Floor		
3.01	26.44	ACADEMIC STAFF OFFICE
3.03	11.81	ACADEMIC STAFF OFFICE
3.04	11.81	ACADEMIC STAFF OFFICE
3.05	11.8	ACADEMIC STAFF OFFICE
3.06	11.79	ACADEMIC STAFF OFFICE
3.07	11.83	ACADEMIC STAFF OFFICE
3.08	11.19	ACADEMIC STAFF OFFICE
3.09	11.2	ACADEMIC STAFF OFFICE
3.1	11.59	ACADEMIC STAFF OFFICE
3.11	12.06	ACADEMIC STAFF OFFICE
3.14	7.77	ACADEMIC STAFF OFFICE
3.15	7.55	ACADEMIC STAFF OFFICE
3.21	12.14	ACADEMIC STAFF OFFICE
3.22	11.64	ACADEMIC STAFF OFFICE
3.23	12.31	ACADEMIC STAFF OFFICE
3.24	8.96	ACADEMIC STAFF OFFICE
3.25	10.12	ACADEMIC STAFF OFFICE
3.26	10.11	ACADEMIC STAFF OFFICE
3.27	10.1	ACADEMIC STAFF OFFICE
3.28	21.43	ACADEMIC STAFF OFFICE
3.02	11.67	ADMIN/SUPPORT OFFICE
3.19	16.55	LABORATORY
3.12	20.62	POST GRADUATE OFFICE
3.13	40.57	POST GRADUATE OFFICE
3.2	20.94	POST GRADUATE OFFICE

Lower Ground		
LG.02	90.47	LABORATORY
LG.03	84.17	LABORATORY
LG.06	213.03	LABORATORY
LG.07	133.88	LABORATORY
LG.07A	10.28	LABORATORY
LG.07B	10.41	LABORATORY
LG.08	163.72	LABORATORY
LG.09	107.42	LABORATORY
LG.10	124.3	LABORATORY
LG.12	9.98	LABORATORY
LG.12A	21.1	LABORATORY
LG.13	31.72	LABORATORY
LG.05	16.56	WORKSHOP

Upper Ground		
CORR1	56.79	CORRIDOR
CORR2	83.42	CORRIDOR
CORR3	15.22	CORRIDOR
CORR4	37.51	CORRIDOR
CORR5	40.82	CORRIDOR
CORR6	23.99	CORRIDOR
CORR7	35.87	CORRIDOR
CORR8	17.59	CORRIDOR
UG.02	178.87	LABORATORY
UG.06	18.57	LABORATORY
UG.07	18.58	LABORATORY
UG.08	18.58	LABORATORY
UG.11	11.34	LABORATORY
UG.12	14.1	LABORATORY
UG.13	25.24	LABORATORY
UG.15	27.34	LABORATORY
UG.16	28.56	LABORATORY
UG.17	56.73	LABORATORY
UG.18	143.62	LABORATORY
UG.19A	23.05	LABORATORY
UG.19B	24.91	LABORATORY
UG.PREP	10.86	LABORATORY
UG14	30.93	LABORATORY
UG.01	13.85	STAFFROOM

Art & Design Academy

Plate 3: ADA Main Elevation

Plate 4: ADA Rear Elevation

Overview of Main Accommodation: Art & Design Academy

Construction Date:	**2008**
Gross Floor Area:	**11608 sq M**
General Arrangement:	**3 Floors**
Construction Form:	**In-situ Concrete Frame, Brick and panel cladding**
Occupancy:	**Arts, Professional & Social Science**
Student Numbers:	**1336**

Accommodation Schedule

Room No	Room Area m^2	Room Use
1st Floor		
134	21.27	ACADEMIC STAFF OFFICE
135	21.68	ACADEMIC STAFF OFFICE
136	21.67	ACADEMIC STAFF OFFICE
137	21.68	ACADEMIC STAFF OFFICE
138	21.67	ACADEMIC STAFF OFFICE
141	21.41	ACADEMIC STAFF OFFICE
145	21.67	ACADEMIC STAFF OFFICE
146	21.67	ACADEMIC STAFF OFFICE
139	21.67	ADMIN/SUPPORT OFFICE
140	21.64	ADMIN/SUPPORT OFFICE
103	301.64	DESIGN STUDIO
108/109	113.46	DESIGN STUDIO
112	90.03	DESIGN STUDIO
114	82.16	DESIGN STUDIO
117/118	126.8	DESIGN STUDIO
147	179.02	DESIGN STUDIO
126	258.36	WORKSHOP
126A	19.35	WORKSHOP
126B	11.51	WORKSHOP
2nd Floor		
207	65.35	ACADEMIC STAFF OFFICE
215	69.53	ACADEMIC STAFF OFFICE
217	10.67	ACADEMIC STAFF OFFICE
216	10.68	ADMIN/SUPPORT OFFICE
209/11	229.75	DESIGN STUDIO
228/229	200.5	DESIGN STUDIO
236	139.39	DESIGN STUDIO
219	32.21	MEETING ROOM
203	86.61	STAFFROOM
231/232	154.65	WORKSHOP
239/240	99.4	WORKSHOP

3rd Floor		
313	24.09	ACADEMIC STAFF OFFICE
318	55.75	ACADEMIC STAFF OFFICE
319	15.52	ACADEMIC STAFF OFFICE
320	23.57	ACADEMIC STAFF OFFICE
323	11.97	ACADEMIC STAFF OFFICE
324	11.17	ACADEMIC STAFF OFFICE
330	10.86	ACADEMIC STAFF OFFICE
331	10.73	ACADEMIC STAFF OFFICE
333	19.63	ACADEMIC STAFF OFFICE
334	16.18	ACADEMIC STAFF OFFICE
332	10.86	ADMIN/SUPPORT OFFICE
301/16	361.05	DESIGN STUDIO
338/341	291.17	DESIGN STUDIO
321	93.6	SPECIAL TEACHING
325	88.77	SPECIAL TEACHING
336	71.14	SPECIAL TEACHING
4th Floor		
408	121.93	DESIGN STUDIO
409	551.57	DESIGN STUDIO
Ground Floor		
G36	53.56	CONFERENCE
G06/16	709.62	DESIGN STUDIO
G19	228.61	EXHIBITION RESEARCH CENTRE
G23	125.39	LECTURE THEATRE
G17	63.54	LECTURE THEATRE
G21	29.91	SEMINAR
G22	41	SEMINAR
G26	41.5	SEMINAR
Lower Ground		
LG03	9.38	ACADEMIC STAFF OFFICE
LG01	381.51	WORKSHOP
LG01A	75.1	WORKSHOP
LG01B	48.38	WORKSHOP
LG05	10.5	WORKSHOP
LG06	17.39	WORKSHOP

Appendix 2

Participant Details

Reference Number	Institution
1	Bath
2	Birmingham University College
3	Brighton
4	Hertfordshire
5	Hull
6	Leicester
7	Newport
8	Nottingham
9	Open University
10	Oxford
11	Sheffield
12	Staffordshire
13	Westminster
14	Bradford
15	Bristol
16	Cardiff Metropolitan University
17	Central Lancashire
18	Glamorgan
19	Harper Adams University College
20	Lincoln
21	Liverpool John Moores
22	London School of Economics
23	Napier
24	Newcastle Upon Tyne
25	Royal Holloway
26	Salford
27	Coventry
28	Imperial College
29	Southampton
30	Southampton Solent University
31	Kingston
32	Wolverhampton

Appendix 3

Example of Participant Information Sheet & Consent Form

LIVERPOOL JOHN MOORES UNIVERSITY
CONSENT FORM

Developing a pragmatic model for the application of Post-occupancy evaluation (POE) as a facilities performance enhancement tool in the Higher Education Sector

Mike Riley, School of Built Environment

I confirm that I have read and understand the information provided for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and that this will not affect my legal rights

I understand that any personal information collected during the study will be anonymised and remain confidential.

I understand that the researcher will validate and share any direct quotes within the researcher's thesis that are taken from the participants before publication. Any quotes that are not to the satisfaction of the participants will be removed without question.

I agree to take part in the above study

Name of Participant	Date	Signature
Name of Researcher	Date	Signature
Name of Person taking consent *(if different from researcher)*	Date	Signature

Note: When completed 1 copy for participant and 1 copy for researcher

Appendix 4

AUDE Questionnaire within Bristol on-line

LJMU Tom Reilly Building User Satisfaction Survey

Welcome

Welcome to the Liverpool John Moores University Tom Reilly Building User Satisfaction Survey.

We are conducting an evaluation of your building to assess how well it performs for those who occupy it. This information will be used to assess areas that need improvement, provide feedback for similar buildings and projects and to help us better manage the environment.

The survey is completed anonymously, can be saved part way through and takes around 20-30 minutes to complete.

Note that once you have clicked on the CONTINUE button at the bottom of each page you can not return to review or amend that page

Continue >

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LJMU Tom Reilly Building User Satisfaction Survey

Data Protection statement

All data collected in this survey will be held anonymously and securely.

The only identifier that will be held is what occupation group you come under (Admin Staff, Researcher, Lecturer or Student) and attendance type (full or part time)

No personal data is asked for or retained.

Cookies, personal data stored by your Web browser, are not used in this survey.

Continue >

LJMU Tom Reilly Building User Satisfaction Survey

Your Role

Your Role

1. Gender

○ Male ○ Female

2. Occupation

○ Administrative Staff ○ Researcher ○ Academic Staff ○ Student ○ Technical Staff
○ Other *(please specify)*:

Is this full time or part time
○ Full time ○ Part time

3. How long do you spend in the building during the day?

○ Less than 1 hour ○ 1 - 2 hours ○ 3 - 4 hours ○ 5 - 6 hours ○ 7 - 8 hours ○ More than 8 hours

4. How long do you spend working at a computer?
(average hours per day)

○ Less than 1 hour ○ 1 - 2 hours ○ 3 - 4 hours ○ 5 - 6 hours ○ 7 - 8 hours ○ More than 8 hours

Location in Building

5. Location:
In an average week, how much time do you spend in the following types of space (within this building)?
(if you are a student assume during term time)

	Time in Location(Hours)								
	0	**0 - 5**	**6 - 10**	**11 - 15**	**16 - 20**	**21 - 25**	**26 - 30**	**31 - 35**	**more than 35**
a. Office	○	○	○	○	○	○	○	○	○
b. Lecture Room	○	○	○	○	○	○	○	○	○
c. Laboratory	○	○	○	○	○	○	○	○	○

6. If you spend any time in any other location type (within this building), please highlight

them below

	Location type	Time in Location(Hours)								
		0	0 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	31 - 35	More than 35
a. location 1		○	○	○	○	○	○	○	○	○
b. location 2		○	○	○	○	○	○	○	○	○
c. location 3		○	○	○	○	○	○	○	○	○

7. Please rate the quality of the following areas (same areas as highlighted in questions 5 and 6)

	Poor - 1	2	3	4	5	6	7 - Excellent	Not Applicable
a. Office	○	○	○	○	○	○	○	○
b. Lecture room	○	○	○	○	○	○	○	○
c. Laboratory	○	○	○	○	○	○	○	○
d. Location 1	○	○	○	○	○	○	○	○
e. Location 2	○	○	○	○	○	○	○	○
f. Location 3	○	○	○	○	○	○	○	○

Continue >

Survey testing only
Check Answers & Continue >

LJMU Tom Reilly Building User Satisfaction Survey

Building in general and communal areas

Satisfaction with the building

8. How satisfied are you, in overall terms, with the building as a place of work (or study)?

○ 1 - Not satisfied ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very satisfied

Building In General

Security

9. Personal Safety: How safe do your feel in the building?

○ 1 - Unsafe ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very safe

10. Security: What aspects of the environment contribute to feeling safe?

	Not significant - 1	**2**	**3**	**4**	**5**	**6**	**7 - Very significant**
a. Visibility of security personnel	○	○	○	○	○	○	○
b. Access control to the building	○	○	○	○	○	○	○
c. Security zoning (acces control to parts of the building)	○	○	○	○	○	○	○
d. Lighting	○	○	○	○	○	○	○
e. Spatial configuration (i.e. relatively large uncluttered spaces)	○	○	○	○	○	○	○

Accessibility

(can you get into the building and can you move around the building)

11. How accessible is the building from the street, i.e. to the reception door?

○ 1 - Not Accessible ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very Accessible

12. How easy is vertical circulation?
(How easy is it to move between floors?)

○ 1 - Not easy ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very easy

13. How easy is horizontal circulation?
(How easy is it to move about on each floor?)

○ 1 - Not easy ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very easy

Cleanliness

14. How clean is the building?

○ 1 - Dirty ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Clean

Communal Areas

e.g. Entrance foyer / cafe

This section relates to the communal areas in the building and your opinions of them.

15. Is the air fresh or stale?

○ 1 - Stale ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Fresh

16. Is the air humid or dry?

○ 1 - Too humid ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too dry

17. Does the air smell?

○ 1 - Smelly ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - No smell

18. Is the temperature in winter too cold or too warm?

○ 1 - Too cold ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too warm

19. Is the temperature in summer too cold or too warm?

○ 1 - Too cold ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too warm

20. Is this area of the building too noisy or too quiet for your liking?

○ 1 - Too noisy ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too quiet

21. Is this area of the building well lit?

○ 1 - Too bright ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too dark

22. Is there too much or too little natural light?

○ 1 - Too little ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too much

23. Is there too much or too little artificial light?

○ 1 - Too little ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too much

Comments

24. Please provide any comments about the communal areas of this building. This may include factors that have not been highlighted in the questions above. *(Optional)*

Continue >

Survey testing only

Check Answers & Continue >

LJMU Tom Reilly Building User Satisfaction Survey

Location Specific Environmental Conditions - Primary Work Area

Location Specific Environmental Conditions - Primary Work Area

This section relates to your work area where you spend most time, please identify and mark this area as per the zones identified in questions 5, 6 and 7

25. Please select work area type

- ○ Office
- ○ Lecture Room
- ○ Laboratory
- ○ Location 1
- ○ Location 2
- ○ Location 3

Air Quality

26. Does the quality of the air in this part of the building have a negative affect on your work performance?

○ 1 - Not significant ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very significant

27. Is the air fresh or stale?

○ 1 - Stale ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Fresh

28. Is the air humid or dry?

○ 1 - Too humid ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too dry

29. Does the air smell?

○ 1 - Smelly ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - No smell

30. Is there air movement?

○ 1 - Still ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Good circulation

31. Do you have control over ventilation?

○ 1 - No control ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Full control

Temperature

32. Does the temperature in this part of the building have a negative affect on your work performance?

○ 1 - Not significant ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very significant

33. Is the temperature in winter too cold or too warm?

○ 1 - Too cold ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too hot

34. Is the temperature in summer too cold or too warm?

○ 1 - Too cold ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too hot

35. Do you have control over heating?

○ 1 - No control ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Full control

Noise

36. Does the distraction from noise in this part of the building have a negative affect on your work performance?

○ 1 - Not significant ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very significant

37. Is there significant distraction from noise outside the space?

○ 1 - Not significant ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very significant

38. Is there signifcant distraction from background noise?

○ 1 - Not significant ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very significant

Light

39. Does the quality of light in this part of the building have a negative affect on your work performance?

○ 1 - Not significant ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very significant

40. Is there too much or too little natural light?

○ 1 - Too little ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too much

41. Is there too much glare from the sun / natural light?

○ 1 - Too little ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too much

42. Is there too much or too little artificial light?

○ 1 - Too little ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too much

43. Is there too much glare from artificial light?

○ 1 - Too little ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too much

44. Are the blinds / shutters / curtains effective in blocking out natural light?

○ 1 - Not effective ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very effective ○ 8 - None fitted

45. Do you have control over artificial lighting?

○ 1 - No control ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Full Control

IT / Data projection equipment

46. Is the electronic data projection equipment effective?

○ 1 - Does not work well ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Works well ○ 8 - None Fitted

Comments

47. If you have any comments about your primary work area, please feel free to provide them in the space below. *(Optional)*

Continue >

Survey testing only
Check Answers & Continue >

LJMU Tom Reilly Building User Satisfaction Survey

Location Specific Environmental Conditions - Secondary Work Area

Location Specific Environmental Conditions - Secondary Work Area

This relates to your secondary work location, as identified in questions 5, 6 and 7

(eg. your office or desk area if your primary space is a laboratory/practical area)

if you do not have a secondary work area, complete question 48 then click continue at the bottom of the page

48. Please select secondary work area type

- ○ Office
- ○ Lecture Room
- ○ Laboratory
- ○ Location 1
- ○ Location 2
- ○ Location 3
- ○ No secondary area

Air Quality

49. Does the quality of the air in this part of the building have a negative affect on your work performance? *(Optional)*

○ 1 - Not significant ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very significant

50. Is the air stale or fresh? *(Optional)*

○ 1 - Stale ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Fresh

51. Is the air humid or dry *(Optional)*

○ 1 - Too humid ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too dry

52. Does the air smell *(Optional)*

○ 1 - Smelly ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - No Smell

53. Is there air movement *(Optional)*

○ 1 - Still ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Good circulation

54. Do you have control over ventilation? *(Optional)*

○ 1 - No control ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Full control

Temperature

55. Does the temperature in this part of the building have a negative affect on your work performance? *(Optional)*

○ 1 - Not Significant ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very significant

56. Is the temperature in winter too cold or warm? *(Optional)*

○ 1 - Too cold ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too hot

57. Is the temperature during the summer too cold or too warm? *(Optional)*

○ 1 - Too cold ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too hot

58. Do you have control over heating *(Optional)*

○ 1 - No control ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Full control

Noise

59. Does the distraction from noise in this part of the building have a negative affect on your work performance? *(Optional)*

○ 1 - Not significant ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very significant

60. Is there significant distraction from noise outside the space? *(Optional)*

○ 1 - Not significant ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very significant

61. Is there significant distraction from background noise? *(Optional)*

○ 1 - Not significant ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very significant

Light

62. Does the quality of light in this part of the building have a negative affect on your work performance? *(Optional)*

○ 1 - Not significant ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very significant

63. Is there too much or too little natural light? *(Optional)*

○ 1 - Too little ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too much

64. Is there too much glare from the sun / natural light? *(Optional)*

○ 1 - Too little ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too much

65. Is there too much or too little artificial light? *(Optional)*

○ 1 - Too little ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too much

66. Is there too much glare from artificial light? *(Optional)*

○ 1 - Too little ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Too much

67. Are the blinds / shutters / curtains effective in blocking out natural light *(Optional)*

○ 1 - Not effective ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Very effective ○ 8 - None fitted

68. Do you have control over artificial lighting? *(Optional)*

○ 1 - No control ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Full control

IT / Data projection equipment

69. Is the electronic data projection equipment effective? *(Optional)*

○ 1 - Does not work well ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 - Works well ○ 8 - None fitted

Comments

70. If you have any comments about your secondary work area, please feel free to provide them in the space below *(Optional)*

Continue >

Survey testing only
Check Answers & Continue >

LJMU Tom Reilly Building User Satisfaction Survey

General Comments

General Comments

71. If you have any additional comments that you would like to make about any aspect of your work environment please note them here.

If you feel there are other aspects that contribute to the work environment, that have not been covered in this survey, please highlight them here. *(Optional)*

Continue >

Survey testing only
Check Answers & Continue >

LJMU Tom Reilly Building User Satisfaction Survey

Final Page

Thank you for completing this survey.

The results of this survey will be made available after analysis

Appendix 5

Example Bristol On-line Summary

LJMU Tom Reilly Building User Satisfaction Survey results

Survey overview

Number of respondents: 95
Expected number of respondents: 350
Response rate: 27.1%
Launch date: 21 Oct 2011
Close date: 20 Nov 2011

Section 1: Your Role

1. Gender		
Male:	50.5%	48
Female:	49.5%	47

2. Occupation		
Administrative Staff:	5.3%	5
Researcher:	12.6%	12
Academic Staff:	15.8%	15
Student:	58.9%	56
Technical Staff:	6.3%	6
Other *(please specify)*:	1.1%	1
Research Officer		
2.a. Is this full time or part time		
Full time:	90.5%	86
Part time:	9.5%	9

3. How long do you spend in the building during the day?		
Less than 1 hour:	13.7%	13
1 - 2 hours:	26.3%	25
3 - 4 hours:	14.7%	14
5 - 6 hours:	7.4%	7
7 - 8 hours:	21.1%	20
More than 8 hours:	16.8%	16

4. How long do you spend working at a computer? (average hours per day)		
Less than 1 hour:	16.8%	16
1 - 2 hours:	18.9%	18
3 - 4 hours:	26.3%	25
5 - 6 hours:	20.0%	19
7 - 8 hours:	14.7%	14
More than 8 hours:	3.2%	3

Section 2: Location in Building

5. Location:		
5.a. Office -- Time in Location(Hours)		
0:	43.2%	41
0 - 5:	18.9%	18
6 - 10:	3.2%	3
11 - 15:	3.2%	3
16 - 20:	6.3%	6
21 - 25:	7.4%	7
26 - 30:	5.3%	5
31 - 35:	4.2%	4
more than 35:	8.4%	8
5.b. Lecture Room -- Time in Location(Hours)		
0:	24.2%	23
0 - 5:	60.0%	57
6 - 10:	11.6%	11
11 - 15:	2.1%	2
16 - 20:	1.1%	1
21 - 25:	1.1%	1
26 - 30:	0.0%	0
31 - 35:	0.0%	0
more than 35:	0.0%	0
5.c. Laboratory -- Time in Location(Hours)		
0:	34.7%	33
0 - 5:	43.2%	41
6 - 10:	10.5%	10
11 - 15:	4.2%	4
16 - 20:	3.2%	3
21 - 25:	2.1%	2
26 - 30:	0.0%	0
31 - 35:	1.1%	1
more than 35:	1.1%	1

6. If you spend any time in any other location type (within this building), please highlight them below		
6.a. location 1 -- Location type		
- There are too many responses to display on this page and so all the responses to this question are available on a separate page.		
6.a.i. location 1 -- Time in Location(Hours)		
0:	50.0%	20
0 - 5:	40.0%	16

6 - 10:		7.5%	3
11 - 15:		2.5%	1
16 - 20:		0.0%	0
21 - 25:		0.0%	0
26 - 30:		0.0%	0
31 - 35:		0.0%	0
More than 35:		0.0%	0
6.b. location 2 -- Location type			
Observation Room (Tutorial)			
6.b.i. location 2 -- Time in Location(Hours)			
0:		84.0%	21
0 - 5:		16.0%	4
6 - 10:		0.0%	0
11 - 15:		0.0%	0
16 - 20:		0.0%	0
21 - 25:		0.0%	0
26 - 30:		0.0%	0
31 - 35:		0.0%	0
More than 35:		0.0%	0
6.c. location 3 -- Location type			
6.c.i. location 3 -- Time in Location(Hours)			
0:		83.3%	20
0 - 5:		16.7%	4
6 - 10:		0.0%	0
11 - 15:		0.0%	0
16 - 20:		0.0%	0
21 - 25:		0.0%	0
26 - 30:		0.0%	0
31 - 35:		0.0%	0
More than 35:		0.0%	0

7. Please rate the quality of the following areas (same areas as highlighted in questions 5 and 6)			
7.a. Office			
Poor - 1:		6.3%	6
2:		3.2%	3
3:		5.3%	5
4:		13.7%	13
5:		15.8%	15
6:		10.5%	10
7 - Excellent:		9.5%	9
Not Applicable:		35.8%	34

7.b. Lecture room		
Poor - 1:	2.1%	2
2:	4.2%	4
3:	1.1%	1
4:	11.6%	11
5:	21.1%	20
6:	15.8%	15
7 - Excellent:	25.3%	24
Not Applicable:	18.9%	18
7.c. Laboratory		
Poor - 1:	1.1%	1
2:	3.2%	3
3:	3.2%	3
4:	1.1%	1
5:	11.6%	11
6:	16.8%	16
7 - Excellent:	33.7%	32
Not Applicable:	29.5%	28
7.d. Location 1		
Poor - 1:	4.2%	4
2:	2.1%	2
3:	2.1%	2
4:	1.1%	1
5:	3.2%	3
6:	5.3%	5
7 - Excellent:	6.3%	6
Not Applicable:	75.8%	72
7.e. Location 2		
Poor - 1:	4.2%	4
2:	2.1%	2
3:	1.1%	1
4:	1.1%	1
5:	2.1%	2
6:	1.1%	1
7 - Excellent:	1.1%	1
Not Applicable:	87.4%	83
7.f. Location 3		
Poor - 1:	4.2%	4
2:	2.1%	2
3:	1.1%	1
4:	1.1%	1

5:		1.1%	1
6:		1.1%	1
7 - Excellent:		1.1%	1
Not Applicable:		88.4%	84

Section 3: Satisfaction with the building

8. How satisfied are you, in overall terms, with the building as a place of work (or study)?			
1 - Not satisfied:		5.3%	5
2:		2.1%	2
3:		6.3%	6
4:		11.6%	11
5:		14.7%	14
6:		29.5%	28
7 - Very satisfied:		30.5%	29

Section 4: Building In General

9. Personal Safety: How safe do your feel in the building?			
1 - Unsafe:		0.0%	0
2:		1.1%	1
3:		0.0%	0
4:		7.4%	7
5:		13.7%	13
6:		28.4%	27
7 - Very safe:		49.5%	47

10. Security: What aspects of the environment contribute to feeling safe?			
10.a. Visibility of security personnel			
Not significant - 1:		33.7%	32
2:		13.7%	13
3:		7.4%	7
4:		16.8%	16
5:		13.7%	13
6:		8.4%	8
7 - Very significant:		6.3%	6
10.b. Access control to the building			
Not significant - 1:		3.2%	3
2:		7.4%	7
3:		4.2%	4
4:		15.8%	15

5:		15.8%	15
6:		27.4%	26
7 - Very significant:		26.3%	25
10.c. Security zoning (acces control to parts of the building)			
Not significant - 1:		9.5%	9
2:		2.1%	2
3:		10.5%	10
4:		13.7%	13
5:		16.8%	16
6:		24.2%	23
7 - Very significant:		23.2%	22
10.d. Lighting			
Not significant - 1:		8.4%	8
2:		5.3%	5
3:		10.5%	10
4:		20.0%	19
5:		17.9%	17
6:		22.1%	21
7 - Very significant:		15.8%	15
10.e. Spatial configuration (i.e. relatively large uncluttered spaces)			
Not significant - 1:		12.6%	12
2:		7.4%	7
3:		8.4%	8
4:		15.8%	15
5:		24.2%	23
6:		21.1%	20
7 - Very significant:		10.5%	10

11. How accessible is the building from the street, i.e. to the reception door?			
1 - Not Accessible:		3.2%	3
2:		4.2%	4
3:		5.3%	5
4:		8.4%	8
5:		22.1%	21
6:		22.1%	21
7 - Very Accessible:		34.7%	33

12. How easy is vertical circulation? (How easy is it to move between floors?)			
1 - Not easy:		2.1%	2
2:		4.2%	4
3:		13.7%	13

4:		12.6%	12
5:		21.1%	20
6:		25.3%	24
7 - Very easy:		21.1%	20

13. How easy is horizontal circulation? (How easy is it to move about on each floor?)			
1 - Not easy:		0.0%	0
2:		4.2%	4
3:		5.3%	5
4:		11.6%	11
5:		24.2%	23
6:		25.3%	24
7 - Very easy:		29.5%	28

14. How clean is the building?			
1 - Dirty:		0.0%	0
2:		0.0%	0
3:		3.2%	3
4:		3.2%	3
5:		8.4%	8
6:		32.6%	31
7 - Clean:		52.6%	50

Section 5: Communal Areas

15. Is the air fresh or stale?			
1 - Stale:		3.2%	3
2:		1.1%	1
3:		4.2%	4
4:		9.5%	9
5:		21.1%	20
6:		36.8%	35
7 - Fresh:		24.2%	23

16. Is the air humid or dry?			
1 - Too humid:		1.1%	1
2:		2.1%	2
3:		4.2%	4
4:		48.4%	46
5:		30.5%	29
6:		9.5%	9

7 - Too dry:		4.2%	4

17. Does the air smell?			
1 - Smelly:		0.0%	0
2:		0.0%	0
3:		10.5%	10
4:		11.6%	11
5:		11.6%	11
6:		30.5%	29
7 - No smell:		35.8%	34

18. Is the temperature in winter too cold or too warm?			
1 - Too cold:		6.3%	6
2:		6.3%	6
3:		10.5%	10
4:		48.4%	46
5:		15.8%	15
6:		9.5%	9
7 - Too warm:		3.2%	3

19. Is the temperature in summer too cold or too warm?			
1 - Too cold:		5.3%	5
2:		2.1%	2
3:		2.1%	2
4:		50.5%	48
5:		22.1%	21
6:		11.6%	11
7 - Too warm:		6.3%	6

20. Is this area of the building too noisy or too quiet for your liking?			
1 - Too noisy:		2.1%	2
2:		1.1%	1
3:		8.4%	8
4:		52.6%	50
5:		25.3%	24
6:		7.4%	7
7 - Too quiet:		3.2%	3

21. Is this area of the building well lit?			
1 - Too bright:		2.1%	2
2:		4.2%	4
3:		7.4%	7

4:		53.7%	51
5:		22.1%	21
6:		9.5%	9
7 - Too dark:		1.1%	1

22. Is there too much or too little natural light?			
1 - Too little:		15.8%	15
2:		6.3%	6
3:		9.5%	9
4:		47.4%	45
5:		20.0%	19
6:		1.1%	1
7 - Too much:		0.0%	0

23. Is there too much or too little artificial light?			
1 - Too little:		1.1%	1
2:		2.1%	2
3:		2.1%	2
4:		49.5%	47
5:		20.0%	19
6:		13.7%	13
7 - Too much:		11.6%	11

24. Please provide any comments about the communal areas of this building. This may include factors that have not been highlighted in the questions above.
- There are too many responses to display on this page and so all the responses to this question are available on a separate page.

Section 6: Location Specific Environmental Conditions - Primary Work Area

25. Please select work area type			
Office:		35.8%	34
Lecture Room:		37.9%	36
Laboratory:		20.0%	19
Location 1:		6.3%	6
Location 2:		0.0%	0
Location 3:		0.0%	0

26. Does the quality of the air in this part of the building have a negative affect on your work performance?			
1 - Not significant:		30.5%	29
2:		11.6%	11
3:		6.3%	6

4:		16.8%	16
5:		13.7%	13
6:		16.8%	16
7 - Very significant:		4.2%	4

27. Is the air fresh or stale?			
1 - Stale:		3.2%	3
2:		5.3%	5
3:		9.5%	9
4:		25.3%	24
5:		13.7%	13
6:		27.4%	26
7 - Fresh:		15.8%	15

28. Is the air humid or dry?			
1 - Too humid:		1.1%	1
2:		2.1%	2
3:		4.2%	4
4:		56.8%	54
5:		21.1%	20
6:		8.4%	8
7 - Too dry:		6.3%	6

29. Does the air smell?			
1 - Smelly:		0.0%	0
2:		4.2%	4
3:		5.3%	5
4:		30.5%	29
5:		8.4%	8
6:		24.2%	23
7 - No smell:		27.4%	26

30. Is there air movement?			
1 - Still:		9.5%	9
2:		12.6%	12
3:		7.4%	7
4:		10.5%	10
5:		20.0%	19
6:		24.2%	23
7 - Good circulation:		15.8%	15

1 - No control:		38.9%	37
2:		17.9%	17
3:		3.2%	3
4:		6.3%	6
5:		15.8%	15
6:		8.4%	8
7 - Full control:		9.5%	9

32. Does the temperature in this part of the building have a negative affect on your work performance?			
1 - Not significant:		25.3%	24
2:		14.7%	14
3:		5.3%	5
4:		15.8%	15
5:		11.6%	11
6:		17.9%	17
7 - Very significant:		9.5%	9

33. Is the temperature in winter too cold or too warm?			
1 - Too cold:		7.4%	7
2:		8.4%	8
3:		3.2%	3
4:		52.6%	50
5:		15.8%	15
6:		9.5%	9
7 - Too hot:		3.2%	3

34. Is the temperature in summer too cold or too warm?			
1 - Too cold:		8.4%	8
2:		2.1%	2
3:		4.2%	4
4:		50.5%	48
5:		18.9%	18
6:		9.5%	9
7 - Too hot:		6.3%	6

35. Do you have control over heating?			
1 - No control:		42.1%	40
2:		15.8%	15
3:		6.3%	6
4:		9.5%	9
5:		11.6%	11
6:		6.3%	6

7 - Full control:		8.4%	8

36. Does the distraction from noise in this part of the building have a negative affect on your work performance?			
1 - Not significant:		40.0%	38
2:		10.5%	10
3:		8.4%	8
4:		10.5%	10
5:		16.8%	16
6:		10.5%	10
7 - Very significant:		3.2%	3

37. Is there significant distraction from noise outside the space?			
1 - Not significant:		32.6%	31
2:		24.2%	23
3:		6.3%	6
4:		12.6%	12
5:		7.4%	7
6:		11.6%	11
7 - Very significant:		5.3%	5

38. Is there signifcant distraction from background noise?			
1 - Not significant:		34.7%	33
2:		18.9%	18
3:		11.6%	11
4:		10.5%	10
5:		14.7%	14
6:		6.3%	6
7 - Very significant:		3.2%	3

39. Does the quality of light in this part of the building have a negative affect on your work performance?			
1 - Not significant:		29.5%	28
2:		13.7%	13
3:		10.5%	10
4:		11.6%	11
5:		16.8%	16
6:		10.5%	10
7 - Very significant:		7.4%	7

40. Is there too much or too little natural light?			
1 - Too little:		17.9%	17
2:		5.3%	5

3:	9.5%	9
4:	48.4%	46
5:	12.6%	12
6:	5.3%	5
7 - Too much:	1.1%	1

41. Is there too much glare from the sun / natural light?		
1 - Too little:	15.8%	15
2:	6.3%	6
3:	8.4%	8
4:	42.1%	40
5:	12.6%	12
6:	12.6%	12
7 - Too much:	2.1%	2

42. Is there too much or too little artificial light?		
1 - Too little:	1.1%	1
2:	0.0%	0
3:	1.1%	1
4:	49.5%	47
5:	16.8%	16
6:	15.8%	15
7 - Too much:	15.8%	15

43. Is there too much glare from artificial light?		
1 - Too little:	1.1%	1
2:	3.2%	3
3:	5.3%	5
4:	60.0%	57
5:	15.8%	15
6:	9.5%	9
7 - Too much:	5.3%	5

44. Are the blinds / shutters / curtains effective in blocking out natural light?		
1 - Not effective:	4.2%	4
2:	1.1%	1
3:	9.5%	9
4:	9.5%	9
5:	16.8%	16
6:	16.8%	16
7 - Very effective:	16.8%	16
8 - None fitted:	25.3%	24

45. Do you have control over artificial lighting?			
1 - No control:		24.2%	23
2:		8.4%	8
3:		6.3%	6
4:		17.9%	17
5:		12.6%	12
6:		10.5%	10
7 - Full Control:		20.0%	19

46. Is the electronic data projection equipment effective?			
1 - Does not work well:		0.0%	0
2:		3.2%	3
3:		5.3%	5
4:		5.3%	5
5:		11.6%	11
6:		13.7%	13
7 - Works well:		30.5%	29
8 - None Fitted:		30.5%	29

47. If you have any comments about your primary work area, please feel free to provide them in the space below.
- There are too many responses to display on this page and so all the responses to this question are available on a separate page.

Section 7: Location Specific Environmental Conditions - Secondary Work Area

48. Please select secondary work area type			
Office:		6.3%	6
Lecture Room:		18.9%	18
Laboratory:		31.6%	30
Location 1:		1.1%	1
Location 2:		1.1%	1
Location 3:		0.0%	0
No secondary area:		41.1%	39

49. Does the quality of the air in this part of the building have a negative affect on your work performance?			
1 - Not significant:		25.0%	14
2:		12.5%	7
3:		10.7%	6
4:		19.6%	11
5:		12.5%	7

6:		14.3%	8
7 - Very significant:		5.4%	3

50. Is the air stale or fresh?			
1 - Stale:		3.8%	2
2:		7.5%	4
3:		11.3%	6
4:		28.3%	15
5:		13.2%	7
6:		20.8%	11
7 - Fresh:		15.1%	8

51. Is the air humid or dry			
1 - Too humid:		2.0%	1
2:		2.0%	1
3:		9.8%	5
4:		58.8%	30
5:		15.7%	8
6:		11.8%	6
7 - Too dry:		0.0%	0

52. Does the air smell			
1 - Smelly:		0.0%	0
2:		2.1%	1
3:		6.2%	3
4:		20.8%	10
5:		8.3%	4
6:		22.9%	11
7 - No Smell:		39.6%	19

53. Is there air movement			
1 - Still:		4.3%	2
2:		19.6%	9
3:		6.5%	3
4:		19.6%	9
5:		19.6%	9
6:		13.0%	6
7 - Good circulation:		17.4%	8

54. Do you have control over ventilation?			
1 - No control:		34.0%	17
2:		14.0%	7

3:	8.0%	4
4:	10.0%	5
5:	16.0%	8
6:	16.0%	8
7 - Full control:	2.0%	1

55. Does the temperature in this part of the building have a negative affect on your work performance?

1 - Not Significant:	26.9%	14
2:	9.6%	5
3:	5.8%	3
4:	17.3%	9
5:	11.5%	6
6:	17.3%	9
7 - Very significant:	11.5%	6

56. Is the temperature in winter too cold or warm?

1 - Too cold:	9.8%	5
2:	9.8%	5
3:	3.9%	2
4:	51.0%	26
5:	11.8%	6
6:	7.8%	4
7 - Too hot:	5.9%	3

57. Is the temperature during the summer too cold or too warm?

1 - Too cold:	4.0%	2
2:	6.0%	3
3:	4.0%	2
4:	54.0%	27
5:	14.0%	7
6:	10.0%	5
7 - Too hot:	8.0%	4

58. Do you have control over heating

1 - No control:	45.1%	23
2:	11.8%	6
3:	2.0%	1
4:	17.6%	9
5:	13.7%	7
6:	5.9%	3
7 - Full control:	3.9%	2

59. Does the distraction from noise in this part of the building have a negative affect on your work performance?		
1 - Not significant:	32.7%	17
2:	15.4%	8
3:	7.7%	4
4:	19.2%	10
5:	9.6%	5
6:	7.7%	4
7 - Very significant:	7.7%	4

60. Is there significant distraction from noise outside the space?		
1 - Not significant:	34.6%	18
2:	15.4%	8
3:	5.8%	3
4:	19.2%	10
5:	11.5%	6
6:	11.5%	6
7 - Very significant:	1.9%	1

61. Is there significant distraction from background noise?		
1 - Not significant:	32.7%	17
2:	19.2%	10
3:	1.9%	1
4:	19.2%	10
5:	15.4%	8
6:	9.6%	5
7 - Very significant:	1.9%	1

62. Does the quality of light in this part of the building have a negative affect on your work performance?		
1 - Not significant:	26.1%	12
2:	10.9%	5
3:	2.2%	1
4:	34.8%	16
5:	8.7%	4
6:	8.7%	4
7 - Very significant:	8.7%	4

63. Is there too much or too little natural light?		
1 - Too little:	14.6%	7
2:	6.2%	3
3:	4.2%	2
4:	58.3%	28

5:		12.5%	6
6:		2.1%	1
7 - Too much:		2.1%	1

64. Is there too much glare from the sun / natural light?			
1 - Too little:		10.4%	5
2:		6.2%	3
3:		2.1%	1
4:		60.4%	29
5:		18.8%	9
6:		0.0%	0
7 - Too much:		2.1%	1

65. Is there too much or too little artificial light?			
1 - Too little:		0.0%	0
2:		0.0%	0
3:		6.4%	3
4:		57.4%	27
5:		10.6%	5
6:		10.6%	5
7 - Too much:		14.9%	7

66. Is there too much glare from artificial light?			
1 - Too little:		0.0%	0
2:		4.3%	2
3:		8.5%	4
4:		57.4%	27
5:		17.0%	8
6:		8.5%	4
7 - Too much:		4.3%	2

67. Are the blinds / shutters / curtains effective in blocking out natural light			
1 - Not effective:		0.0%	0
3:		4.1%	2
4:		12.2%	6
5:		18.4%	9
6:		14.3%	7
7 - Very effective:		14.3%	7
8 - None fitted:		36.7%	18

68. Do you have control over artificial lighting?			
1 - No control:		21.3%	10

2:		6.4%	3
3:		0.0%	0
4:		19.1%	9
5:		19.1%	9
6:		12.8%	6
7 - Full control:		21.3%	10

69. Is the electronic data projection equipment effective?			
1 - Does not work well:		0.0%	0
2:		0.0%	0
3:		7.8%	4
4:		5.9%	3
5:		11.8%	6
6:		7.8%	4
7 - Works well:		29.4%	15
8 - None fitted:		37.3%	19

70. If you have any comments about your secondary work area, please feel free to provide them in the space below
- There are too many responses to display on this page and so all the responses to this question are available on a separate page.

Section 8: General Comments

71. If you have any additional comments that you would like to make about any aspect of your work environment please note them here. If you feel there are other aspects that contribute to the work environment, that have not been covered in this survey, please highlight them here.
- There are too many responses to display on this page and so all the responses to this question are available on a separate page.

Appendix 6

Summarised Data from AUDE Questionnaire referred to in Chapter 5 :

(Analysis and Evaluation of the Application of POE in Higher Education Institutions)

Survey Instance		Chronbach's alpha	Inter-item correlation –ive values?	Inter-item correlation value
ADA 2010	Satisfaction	0.733	Yes	0.167
	Bi-polar	0.673	Yes	0.108
ADA 2012	Satisfaction	0.706	Yes	0.171
	Bi-polar	0.592	Yes	0.088
TRB 2010	Satisfaction	0.493	Yes	0.059
	Bi-polar	0.509	Yes	0.059
TRB 2013	Satisfaction	0.730	Yes	0.157
	Bi-polar	0.047	Yes	0.007

Table A6.1: Summarised results from Chronbach's alpha test

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	25	3.84	1.75
	2012	23	4.09	2.10
Tom Reilly Building	2010	61	4.54	1.77
	2013	36	3.97	1.92

(1=poor; 7=excellent)

Table A6.2: Questionnaire scores for perception of office quality

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	52	4.62	1.44
	2012	33	3.64	1.75
Tom Reilly Building	2010	76	5.38	1.56
	2013	34	3.94	1.97

(1=poor; 7=excellent)

Table A6.3: Questionnaire scores for perception of lecture room quality

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	11	3.73	1.68
	2012	6	2.83	2.23
Tom Reilly Building	2010	68	5.90	1.48
	2013	25	4.84	1.77

(1=poor; 7=excellent)

Table A6.4: Questionnaire scores for perception of laboratory quality

Building	Date	nTotal	n7d	n7e	n7f
Art & Design |Academy	2010	57	47	50	30
	2012	40	29	14	9
Tom Reilly Building	2010	95	23	12	11
	2013	53	14	5	2

Table A6.5: Response rates for questions related to perceived quality

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	47	4.47	1.59
	2012	29	4.14	1.89
Tom Reilly Building	2010	23	4.57	2.29
	2013	14	3.14	2.44

(1=poor; 7=excellent)

Table A6.6: Questionnaire scores for perception of quality 'Location 1'

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	50	3.98	1.55
	2012	14	3.36	2.13
Tom Reilly Building	2010	12	3.17	2.17
	2013	5	1.40	0.55

(1=poor; 7=excellent)

Table A6.7: Questionnaire scores for perception of quality 'Location 2'

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	30	4.00	1.36
	2012	9	2.89	2.09
Tom Reilly Building	2010	11	3.00	2.20
	2013	2	1.00	0.00

(1=poor; 7=excellent)

Table A6.8: Questionnaire scores for perception of quality 'Location 3'

TRB2010

Correlations

			Q7a	Q7b	Q7c	Q8
Spearman's rho	Q8	Correlation Coefficient	.064	.750**	.653**	1.000
		Sig. (2-tailed)	.624	.000	.000	.
		N	61	76	68	95

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.9: Correlations between perception of quality and overall satisfaction TRB 2010

TRB 2013

Correlations

			Q7a	Q7b	Q7c	Q8
Spearman's rho	Q8	Correlation Coefficient	.585**	.590**	.511**	1.000
		Sig. (2-tailed)	.000	.000	.009	.
		N	36	34	25	43

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.10: Correlations between perception of quality and overall satisfaction TRB 2013

ADA2010

Correlations

			Q7a	Q7b	Q7c	Q8
Spearman's rho	Q8	Correlation Coefficient	.753**	.664**	.579	1.000
		Sig. (2-tailed)	.000	.000	.062	.
		N	25	52	11	57

**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.11: Correlations between perception of quality and overall satisfaction ADA 2010

ADA 2012

Correlations

			Q7a	Q7b	Q7c	Q8
Spearman's rho	Q8	Correlation Coefficient	.737**	.515**	.813*	1.000
		Sig. (2-tailed)	.000	.002	.049	.
		N	23	33	6	40

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table A6.12: Correlations between perception of quality and overall satisfaction ADA 2012

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.63	1.65
	2012	40	4.72	1.83
Tom Reilly Building	2010	95	5.41	1.69
	2013	43	3.86	1.59

(1=not satisfied; 7=very satisfied)

Table A6.13: Questionnaire scores for perception of overall satisfaction

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	7	4.71	1.41
	2012	11	4.00	2.00
Tom Reilly Building	2010	15	4.80	2.21
	2013	31	4.10	1.40

Table A6.14: Questionnaire scores for perception of overall satisfaction; Academic Staff

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	44	4.70	1.58
	2012	21	5.05	1.88
Tom Reilly Building	2010	56	5.59	1.44
	2013	1	Excluded	Excluded

Table A6.15: Questionnaire scores for perception of overall satisfaction: Students

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	5.26	1.82
	2012	40	5.20	1.83
Tom Reilly Building	2010	95	6.17	1.04
	2013	43	5.12	1.42

(1=safe; 7=unsafe)

Table A6.16: Questionnaire scores for perception of personal safety

Building	Date		Mean	Standard Deviation
Art & Design |Academy	2010	57	4.67	1.78
	2012	40	4.35	1.92
Tom Reilly Building	2010	95	3.14	1.99
	2013	43	3.12	2.16

(1=not significant; 7=very significant)

Table A6.17: Questionnaire scores for perception of significance of visibility of security personnel

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.60	1.73
	2012	40	4.60	1.85
Tom Reilly Building	2010	95	6.21	1.67
	2013	43	4.70	1.83

(1=not significant; 7=very significant)

Table A6.18: Questionnaire scores for perception of significance of access control

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.25	1.79
	2012	40	4.55	1.96
Tom Reilly Building	2010	95	4.92	1.86
	2013	43	4.63	1.49

(1=not significant; 7=very significant)

Table A6.19: Questionnaire scores for perception of significance of security zoning

10.d. Lighting

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.49	1.76
	2012	40	4.95	1.83
Tom Reilly Building	2010	95	4.63	1.78
	2013	43	4.35	1.70

(1=not significant; 7=very significant)

Table A6.20: Questionnaire scores for perception of significance of lighting to security

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	4.54	1.72
	2012	40	4.77	1.64
Tom Reilly Building	2010	95	4.37	1.86
	2013	43	4.02	1.50

(1=not significant; 7=very significant)

Table A6.21: Questionnaire scores for perception of significance of spatial configuration to security

ADA2010

Correlations

			Q9	Q10a	Q10b	Q10c	Q10d	Q10e
Spearman's rho	Q9	Correlation Coefficient	1.000	.138	-.177	-.107	.006	.284*
		Sig. (2-tailed)	.	.305	.189	.430	.967	.032
		N	57	57	57	57	57	57

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.22: Correlations between perception of security and related factors ADA 2010

ADA2012

Correlations

			Q9	Q10a	Q10b	Q10c	Q10d	Q10e
Spearman's rho	Q9	Correlation Coefficient	1.000	-.375*	-.225	-.070	-.019	.222
		Sig. (2-tailed)	.	.017	.162	.666	.909	.168
		N	40	40	40	40	40	40

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.23: Correlations between perception of quality and overall satisfaction ADA 2012

TRB2010

Correlations

			Q9	Q10a	Q10b	Q10c	Q10d	Q10e
Spearman's rho	Q9	Correlation Coefficient	1.000	-.083	.417**	.359**	.088	.153
		Sig. (2-tailed)	.	.423	.000	.000	.397	.140
		N	95	95	95	95	95	95

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table A6.24: Correlations between perception of quality and overall satisfaction TRB 2010

TRB 2013

Correlations

			Q9	Q10a	Q10b	Q10c	Q10d	Q10e
Spearman's rho	Q9	Correlation Coefficient	1.000	-.357*	.160	-.051	-.114	.042
		Sig. (2-tailed)	.	.019	.306	.743	.465	.790
		N	43	43	43	43	43	43

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.25: Correlations between perception of quality and overall satisfaction TRB 2013

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	6.21	1.26
	2012	40	6.30	1.04
Tom Reilly Building	2010	95	5.47	1.61
	2013	43	5.07	1.65

(1=not accessible; 7=very accessible)

Table A6.26: Questionnaire scores for perception of accessibility from the street

Building	**Date**	**n**	**Mean**	**Standard Deviation**
Art & Design Academy	2010	57	6.00	1.24
	2012	40	6.37	1.19
Tom Reilly Building	2010	95	5.06	1.58
	2013	43	4.74	1.74

(1=not easy; 7=easy)

Table A6.27: Questionnaire scores for perception of ease of vertical circulation

Building	**Date**	**n**	**Mean**	**Standard Deviation**
Art & Design Academy	2010	57	6.16	1.08
	2012	40	6.57	0.87
Tom Reilly Building	2010	95	5.49	1.38
	2013	43	5.00	1.69

(1=not easy; 7=easy)

Table A6.28: Questionnaire scores for perception of ease of horizontal circulation

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	5.63	1.41
	2012	40	5.37	1.68
Tom Reilly Building	2010	95	6.28	0.97
	2013	43	5.79	1.18

(1=dirty; 7=clean)

Table A6.29: Questionnaire scores for perception of cleanliness

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	5.84	1.39
	2012	40	5.92	1.18
Tom Reilly Building	2010	95	5.52	1.40
	2013	43	5.12	1.43

(1=stale; 7=fresh)

Table A6.30: Questionnaire scores for perception of air freshness: communal areas

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.44	1.10
	2012	40	4.70	.97
Tom Reilly Building	2010	95	4.51	1.02
	2013	43	4.37	0.82

(1=too humid; 7=too dry)

Table A6.31: Questionnaire scores for perception of humidity: communal areas

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	5.53	1.10
	2012	40	6.07	1.06
Tom Reilly Building	2010	95	5.69	1.34
	2013	43	5.79	1.35

(1=smelly; 7=no smell)

Table A6.32: Questionnaire scores for perception of air odour: communal areas

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	3.42	1.87
	2012	40	2.95	1.63
Tom Reilly Building	2010	95	4.02	1.33
	2013	43	3.40	1.33

(1=too cold; 7=too warm)

Table A6.33: Questionnaire scores for perception of winter temperature; communal areas

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	4.70	1.64
	2012	40	4.53	1.24
Tom Reilly Building	2010	95	4.42	1.30
	2013	43	4.05	1.11

(1=too cold; 7=too warm)

Table A6.34: Questionnaire scores for perception of summer temperature; communal areas

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	3.67	1.39
	2012	40	3.68	1.21
Tom Reilly Building	2010	95	4.33	1.03
	2013	43	3.67	0.97

(1=too noisy, 7=too quiet)

Table A6.35: Questionnaire scores for perception of noise in communal areas

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	4.00	1.15
	2012	40	4.10	1.13
Tom Reilly Building	2010	95	4.22	1.04
	2013	43	3.93	0.74

(1=too bright, 7=too dark)

Table A6.36: Questionnaire scores for perception of light levels in communal areas

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.19	1.06
	2012	40	4.05	0.68
Tom Reilly Building	2010	95	3.53	1.34
	2013	43	3.16	1.23

(1=too little, 7=too much)

Table A6.37: Questionnaire scores for perception of natural light levels in communal areas

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.54	1.17
	2012	40	4.55	0.96
Tom Reilly Building	2010	95	4.73	1.22
	2013	43	4.72	1.05

(1=too little, 7=too much)

Table A6.38: Questionnaire scores for perception of artificial light levels in communal areas

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	3.86	1.98
	2012	40	3.77	2.15
Tom Reilly Building	2010	95	3.39	1.03
	2013	43	3.42	1.84

(1=not significant, 7=significant)

Table A6.39: Questionnaire scores for perception of significance of air quality in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.70	1.60
	2012	40	4.78	1.44
Tom Reilly Building	2010	95	4.86	1.59
	2013	43	4.28	1.45

(1=stale, 7=fresh)

Table A6.40: Questionnaire scores for perception air freshness in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.30	1.07
	2012	40	4.47	1.04
Tom Reilly Building	2010	95	4.45	1.07
	2013	43	4.65	1.04

(1=too humid. 7=too dry)

Table A6.41: Questionnaire scores for perception of humidity in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	5.16	1.65
	2012	40	5.53	1.34
Tom Reilly Building	2010	95	5.25	1.48
	2013	43	5.33	1.53

(1=smelly, 7=no smell)

Table A6.42: Questionnaire scores for perception odour in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.47	1.85
	2012	40	4.30	1.60
Tom Reilly Building	2010	95	4.55	1.94
	2013	43	4.14	1.78

(1=still, 7=good circulation)

Table A6.43: Questionnaire scores for perception air movement in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	3.30	1.76
	2012	40	3.32	2.07
Tom Reilly Building	2010	95	3.05	2.18
	2013	43	3.47	2.40

(1=no control, 7=full control)

Table A6.44: Questionnaire scores for perception of control of ventilation in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	5.05	1.94
	2012	40	5.05	1.89
Tom Reilly Building	2010	95	3.65	2.13
	2013	43	4.16	1.86

(1=not significant, 7=very significant)

Table A6.45: Questionnaire scores for perception of significance of temperature in primary work area

Question 33: Is the temperature in winter too cold or too warm?

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	3.26	1.98
	2012	40	3.35	1.87
Tom Reilly Building	2010	95	4.02	1.07
	2013	43	3.70	1.39

(1=too cold, 7=too hot)

Table A6.46: Questionnaire scores for perception winter temperature in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.67	1.65
	2012	40	4.32	1.40
Tom Reilly Building	2010	95	4.23	1.41
	2013	43	4.05	1.34

(1=too cold, 7=too hot)

Table A6.47: Questionnaire scores for perception summer temperature in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	2.12	1.54
	2012	40	2.28	1.92
Tom Reilly Building	2010	95	2.85	2.08
	2013	43	4.12	2.27

(1=no control, 7=full control)

Table A6.48: Questionnaire scores for perception of control of heating in primary work area

Ranks

	Occupation	N	Mean Rank
Q35	Administrative Staff	5	61.00
	Researcher	12	53.96
	Academic Staff	15	64.87
	Student	56	42.66
	Technical Staff	6	25.08
	Total	94	

Table A6.49: Questionnaire scores for perception of control of heating in primary work area by user type (TRB 2013)

Test Statistics[a,b]

	Q35
Chi-Square	15.062
df	4
Asymp. Sig.	.005

a. Kruskal Wallis Test

b. Grouping Variable: Occupation

Table A6.50: Kruskall-Wallis test relating to perception of control of heating in primary work area by user type

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.37	2.26
	2012	40	3.88	2.21
Tom Reilly Building	2010	95	2.98	1.99
	2013	43	3.44	2.03

(1=not significant, 7= very significant)

Table A6.51: Questionnaire scores for perception of significance noise in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	3.67	2.03
	2012	40	3.02	1.75
Tom Reilly Building	2010	95	2.94	1.97
	2013	43	3.40	2.04

(1= not significant, 7=significant)

Table A6.52: Questionnaire scores for perception of significance of noise intrusion in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.12	1.99
	2012	40	3.78	2.04
Tom Reilly Building	2010	95	2.83	1.83
	2013	43	3.67	1.89

(1= not significant, 7=significant)

Table A6.53: Questionnaire scores for perception of significance of background noise in primary work area

Question 39: Does the quality of light in this part of the building have a negative effect on your work performance?

Building	Date	n	Mean	Standard Deviation
Art & Design |Academy	2010	57	4.23	1.96
	2012	40	4.45	2.23
Tom Reilly Building	2010	95	3.34	2.04
	2013	43	3.95	2.07

(1= not significant, 7=significant)

Table A6.54: Questionnaire scores for perception of significance lighting quality in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	3.79	1.22
	2012	40	3.72	1.32
Tom Reilly Building	2010	95	3.53	1.47
	2013	43	3.02	1.46

(1=too little, 7=too much)

Table A6.55: Questionnaire scores for perception of natural light levels primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	4.04	1.25
	2012	40	4.38	1.19
Tom Reilly Building	2010	95	3.76	1.59
	2013	43	3.88	1.55

(1=too little, 7=too much)

Table A6.56: Questionnaire scores for perception of level of glare primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	4.04	1.34
	2012	40	4.13	1.45
Tom Reilly Building	2010	95	4.92	1.13
	2013	43	4.91	1.29

(1=too little, 7=too much)

Table A6.57: Questionnaire scores for perception of artificial light levels primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	4.21	1.09
	2012	40	4.43	1.15
Tom Reilly Building	2010	95	4.36	1.08
	2013	43	4.53	1.30

(1=too little, 7=too much)

Table A6.58: Questionnaire scores for perception of glare from artificial lighting in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	6.19	2.00
	2012	40	5.65	2.43
Tom Reilly Building	2010	95	5.78	1.95
	2013	43	5.93	1.94

(1=not effective, 7=very effective)

Table A6.59: Questionnaire scores for perception of effectiveness of blackout facilities in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	4.32	1.12
	2012	40	4.45	2.44
Tom Reilly Building	2010	95	3.98	2.23
	2013	43	4.49	2.16

(1=no control, 7=full control)

Table A6.60: Questionnaire scores for perception of control over artificial lighting in primary work area

Building	Date	n	Mean	Standard Deviation
Art & Design Academy	2010	57	6.25	2.03
	2012	40	6.28	2.00
Tom Reilly Building	2010	95	6.41	1.64
	2013	43	6.42	1.95

(1=does not work well, 7=works well)

Table A6.61: Questionnaire scores for perception of effectiveness of projection equipment in primary work area

ADA 2010

Correlations

		Q7a	Q7b	Q7c	Q8
Q8	Correlation Coefficient	.753**	.664**	.579	1.000
	Sig. (2-tailed)	.000	.000	.062	
	N	25	52	11	57

**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.62: Correlations between perception of quality and overall satisfaction ADA 2010

ADA 2012

Correlations

		Q7a	Q7b	Q7c	Q8
Q8	Correlation Coefficient	.737**	.515**	.813*	1.000
	Sig. (2-tailed)	.000	.002	.049	.
	N	23	33	6	40

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table A6.63: Correlations between perception of quality and overall satisfaction ADA 2012

TRB 2010

Correlations

		Q7a	Q7b	Q7c	Q8
Q8	Correlation Coefficient	.064	.750**	.653**	1.000
	Sig. (2-tailed)	.624	.000	.000	.
	N	61	76	68	95

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.64: Correlations between perception of quality and overall satisfaction TRB 2010

TRB 2013

Correlations

		Q7a	Q7b	Q7c	Q8
Q8	Correlation Coefficient	.585**	.590**	.511**	1.000
	Sig. (2-tailed)	.000	.000	.009	.
	N	36	34	25	43

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.65: Correlations between perception of quality and overall satisfaction TRB 2013

ADA 2010

Correlations

		Q8	Q9	Q11	Q12	Q13	Q14	Q15	Q27	Q29	Q30	Q31	Q35	Q44	Q45	Q46
Spearman's rho Q8	Correlation Coefficient	1.000	.549**	.054	.299*	.209	.422**	.161	.385**	.157	.163	.074	-.035	.041	-.038	-.010
	Sig (2-tailed)		.000	.689	.024	.119	.001	.232	.003	.244	.226	.583	.794	.761	.781	.942
	N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table A6.66: Correlations between perception of satisfaction with specific factors and overall satisfaction ADA 2010

ADA 2012

Correlations

		Q8	Q9	Q11	Q12	Q13	Q14	Q15	Q27	Q29	Q30	Q31	Q35	Q44	Q45	Q46
Spearman's rho Q8	Correlation Coefficient	1.000	.493**	.028	.219	.302	.376*	.189	.297	.147	.240	.446**	.145	-.031	.346*	-.071
	Sig (2-tailed)		.001	.865	.175	.058	.017	.243	.062	.365	.135	.004	.373	.849	.029	.663
	N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table A6.67: Correlations between perception of satisfaction with specific factors and overall satisfaction ADA 2012

TRB 2010

Correlations

		Q8	Q9	Q11	Q12	Q13	Q14	Q15	Q27	Q29	Q30	Q31	Q35	Q44	Q45	Q46
Spearman's rho Q8	Correlation Coefficient	1.000	-.029	.034	-.021	-.053	.128	-.043	-.159	-.067	-.052	.030	-.095	-.163	-.069	-.184
	Sig (2-tailed)		.780	.747	.838	.612	.218	.677	.124	.518	.618	.776	.359	.115	.507	.074
	N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.68: Correlations between perception of satisfaction with specific factors and overall satisfaction TRB 2010

TRB 2013

Correlations

		Q8	Q9	Q11	Q12	Q13	Q14	Q15	Q27	Q28	Q29	Q30	Q31	Q35	Q44	Q45	Q46
Spearman's rho Q8	Correlation Coefficient	1.000	.612**	.055	.012	.497**	.046	-.052	.179	-.345*	.284	.091	.237	.303*	-.072	.145	.117
	Sig (2-tailed)		.000	.725	.937	.001	.769	.740	.251	.024	.065	.563	.125	.048	.648	.355	.455
	N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table A6.69: Correlations between perception of satisfaction with specific factors and overall satisfaction TRB 2013

ADA 2010

Correlations

			Q8	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q28	Q33	Q34	Q40	Q41	Q42	Q43
Spearman's rho	Q8	Correlation Coefficient	1.000	.041	.140	.102	.006	.285*	-.096	-.055	-.209	-.107	.054	-.111	-.068	-.030	-.081	-.306*
		Sig. (2-tailed)		.765	.297	.449	.963	.032	.478	.682	.119	.427	.687	.411	.616	.824	.550	.021
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.70: Correlations between perception of satisfaction with specific bi-polar factors and overall satisfaction ADA 2010

ADA 2012

Correlations

			Q8	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q28	Q33	Q34	Q40	Q41	Q42	Q43
Spearman's rho	Q8	Correlation Coefficient	1.000	-.161	.239	.625**	.120	.418**	-.019	.198	.058	-.013	.212	.076	.307	.119	.051	-.068
		Sig. (2-tailed)		.321	.138	.000	.460	.007	.908	.221	.722	.938	.189	.641	.054	.463	.754	.677
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table A6.71: Correlations between perception of satisfaction with specific bi-polar factors and overall satisfaction ADA 2012

TRB 2010

Correlations

			Q8	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q28	Q33	Q34	Q40	Q41	Q42	Q43
Spearman's rho	Q8	Correlation Coefficient	1.000	.058	-.109	.055	.043	-.012	-.105	-.067	.114	.018	.175	.012	.074	.131	.103	.126
		Sig. (2-tailed)		.575	.293	.594	.677	.910	.311	.519	.269	.862	.090	.910	.475	.204	.323	.223
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.72: Correlations between perception of satisfaction with specific bi-polar factors and overall satisfaction TRB 2010

TRB 2013

Correlations

			Q8	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q28	Q33	Q34	Q40	Q41	Q42	Q43
Spearman's rho	Q8	Correlation Coefficient	1.000	-.006	.163	.036	.029	-.147	-.234	.170	.046	-.345*	-.041	-.167	.125	.001	-.284	-.315*
		Sig. (2-tailed)		.968	.296	.819	.854	.346	.131	.275	.771	.024	.796	.286	.424	.993	.065	.040
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.73: Correlations between perception of satisfaction with specific bi-polar factors and overall satisfaction TRB 2013

ADA 2010

Correlations

		Q8	Q10a	Q10b	Q10c	Q10d	Q10e	Q26	Q32	Q36	Q37	Q38	Q39
Spearman's rho Q8	Correlation Coefficient	1.000	-.042	-.204	-.188	-.181	.245	-.038	-.029	-.250	-.208	-.234	-.302*
	Sig. (2-tailed)		.758	.128	.161	.178	.066	.779	.830	.060	.121	.080	.022
	N	57	57	57	57	57	57	57	57	57	57	57	57

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.74: Correlations between perception of significance of specific factors and overall satisfaction ADA 2010

ADA 2012

Correlations

		Q8	Q10a	Q10b	Q10c	Q10d	Q10e	Q26	Q32	Q36	Q37	Q38	Q39
Spearman's rho Q8	Correlation Coefficient	1.000	-.303	-.193	-.027	.307	.282	-.386*	-.576**	-.220	-.196	-.339*	-.280
	Sig. (2-tailed)		.058	.234	.869	.054	.078	.014	.000	.173	.225	.033	.080
	N	40	40	40	40	40	40	40	40	40	40	40	40

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.75: Correlations between perception of significance of specific factors and overall satisfaction ADA 2012

TRB 2010

Correlations

		Q8	Q10a	Q10b	Q10c	Q10d	Q10e	Q26	Q32	Q36	Q37	Q38	Q39
Spearman's rho Q8	Correlation Coefficient	1.000	-.156	.007	-.012	-.220*	-.048	.018	.090	-.048	-.005	.029	.125
	Sig. (2-tailed)		.130	.946	.911	.032	.645	.864	.385	.642	.962	.784	.229
	N	95	95	95	95	95	95	95	95	95	95	95	95

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table A6.76: Correlations between perception of significance of specific factors and overall satisfaction TRB 2010

TRB 2013

Correlations

		Q8	Q10a	Q10b	Q10c	Q10d	Q10e	Q26	Q32	Q36	Q37	Q38	Q39
Spearman's rho Q8	Correlation Coefficient	1.000	-.055	.228	-.007	.075	.006	-.550**	-.328*	-.129	.028	-.222	-.487**
	Sig. (2-tailed)		.725	.141	.963	.630	.971	.000	.032	.410	.858	.153	.001
	N	43	43	43	43	43	43	43	43	43	43	43	43

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table A6.77: Correlations between perception of significance of specific factors and overall satisfaction TRB 2013

ADA2010

Correlations

		Q8	Q9	lightsatis	lightbipolar	accesssatis	airsatis	airbipolar	heatbipolar	heatsatis	noisebipolar
Spearman's rho	Correlation Coefficient	1.000	.549**	.025	-.248	.255	.298*	-.010	-.001	-.035	.285*
	Q8 Sig. (2-tailed)		.000	.856	.063	.055	.024	.943	.995	.794	.032
	N	57	57	57	57	57	57	57	57	57	57

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table A6.78: Correlations between sub-scales of themed factors and overall satisfaction ADA 2010

ADA2013

Correlations

		Q8	Q9	lightsatis	lightbipolar	accesssatis	airsatis	airbipolar	heatsatis	heatbipolar	noisebipolar
Spearman's rho	Correlation Coefficient	1.000	.493**	.209	.138	.162	.460**	.105	.145	.406**	.418**
	Q8 Sig. (2-tailed)		.001	.195	.394	.318	.003	.517	.373	.009	.007
	N	40	40	40	40	40	40	40	40	40	40

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table A6.79: Correlations between sub-scales of themed factors and overall satisfaction ADA 2012

TRB2010

Correlations

		Q8	Q9	lightsatisfaction	lightbipolar	accesssatis	airssatis	airbipolar	heatsatis	heatbipolar	noisebipolar
Spearman's rho	Correlation Coefficient	1.000	-.029	-.171	.097	-.027	-.072	-.026	-.095	.095	-.012
	Q8 Sig. (2-tailed)		.780	.098	.352	.795	.487	.799	.359	.361	.910
	N	95	95	95	95	95	95	95	95	95	95

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table A6.80: Correlations between sub-scales of themed factors and overall satisfaction TRB 2010

TRB2013

Correlations

		Q8	lightsatisfaction	lightbipolar	airsatisfaction	acesssatisfaction	airbipolar	heatbipolar	noisebipolar
Spearman's rho	Correlation Coefficient	1.000	.060	-.059	.254	.235	-.061	-.127	-.147
	Q8 Sig. (2-tailed)		.701	.705	.101	.129	.698	.416	.346
	N	43	43	43	43	43	43	43	43

Table A6.81: Correlations between sub-scales of themed factors and overall satisfaction TRB 2013

ADA 2010

Correlations

		Q8	Q9	light	accessibility	airquality	heat	noise
Spearman's rho Q8	Correlation Coefficient	1.000	.549**	-.224	.255	.224	.012	-.205
	Sig. (2-tailed)	.	.000	.094	.055	.093	.930	.126
	N	57	57	57	57	57	57	57

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table A6.82: Correlations between sub-scales of themed factors and overall satisfaction ADA 2010 (amalgamated)

ADA 2012

Correlations

		Q8	Q9	light	accessibility	airquality	heatvent	noise
Spearman's rho Q8	Correlation Coefficient	1.000	.493**	.150	.162	.430**	.214	-.228
	Sig. (2-tailed)	.	.001	.354	.318	.006	.185	.158
	N	40	40	40	40	40	40	40

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table A6.83: Correlations between sub-scales of themed factors and overall satisfaction ADA 2012 (amalgamated)

TRB 2010

Correlations

		Q8	Q9	lighting	airquality	accessibility	heat	noise
Spearman's rho Q8	Correlation Coefficient	1.000	-.029	.025	-.088	-.027	.059	-.019
	Sig. (2-tailed)	.	.780	.813	.398	.795	.568	.854
	N	95	95	95	95	95	95	95

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table A6.84: Correlations between sub-scales of themed factors and overall satisfaction TRB 2010 (amalgamated)

TRB 2013

Correlations

		Q8	Q9	light	access	airquality	heat	noise
Spearman's rho	Q8	Correlation Coefficient	1.000	.612**	-.268	.235	.235	.115	-.164
		Sig. (2-tailed)	.	.000	.082	.129	.129	.463	.293
		N	43	43	43	43	43	43	43

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table A6.85: Correlations between sub-scales of themed factors and overall satisfaction TRB 2013 (amalgamated)

Appendix 7

Examples of Qualitative Comments from AUDE Questionnaire

Art & Design Academy 2010

24. Please provide any comments about the communal areas of this building. This may include factors that have not been highlighted in the questions above.
All the building is freezing all the time. This is the most unpleasant feature of the building
boring walls.. more inspirational works needed.
Buildings lovely just some spaces (like the atrium) could be better developed.. feel sparce
change the timers on the lights to last longer they go off in 10 mins if your the only person in the room at night
I love the building as you interact with people all the time. I believe the acoustics of the building are very poor for classes ect. There is very little wall space to hang work on for staff and students
I would prefer for educational facilities to be the focus, rather than large amounts of money being spent in these areas. As nice as it is having 'designer' furniture around the place, it gets used by a lot of people and will soon need to be replaced which is a real waste. ICT and workshop facilities should be prioritised as the purpose of the building is to educate and these are currently not good enough.
It does not feel like an art school more like an NHS conference centre or an airport. It feels dull and lacks or destroys any creativity.
Not enough comfortable/ socialble areas to sit in
often the communal areas could be used as teaching spaces were it not for discarded food packaging etc. Most of the communal spaces are too reverberant and too bright to display many types of work. This is a problem in general for the building - it is often difficult to display work which is screen-based because of an inability to control the lighting levels (usually way too bright to display work at the degree of subtlety required for high end work). The studios are very cold when the heating is off and the air is very dry and stale when the heating is on in the studio spaces.
Qeustion thirteen the word "move", is spelt as "mobe". I tend to not "Mobe" around the building; although I fully support the group Mobe. Mobe is : "•The National Mobilization Committee to End the War in Vietnam was a relatively short-lived coalition of antiwar activists formed in 1967 to organize large demonstrations in opposition to the Vietnam war. The organization was informally known as "the MOBE"." However, if I see any Mobe activists I will be sure to let security know...
Security as far as I am concerned should include being free from being bullied - from low level intelligence assumptions about age and disability and generalised paranoia... which seems to be abundant in the ADA building. I could cope with building defects - its the human defects I have problems with.

Smells of food are somewhat intrusive at times, although not unpleasant. Hard surfaces accentuate noise when furniture is being moved in the cafe area.
The acoustics of the cafe are horrible. The sound of the chairs scraping on the floor can be heard as you enter the building. Not a welcoming or happy environment.
The heating in Studio 2 is really bad, and so is the internet connection.
The quality in the studios for instance the main ground floor studio, architecture) is AWFUL! too much reverberation when having discussions with tutors and even worse when giving presentations, makes it very difficult to hear/uncomfortable. Some sound absorbing panels added/installed in the ceiling maybe even the walls would hugely improve the space? Can't cost that much.....?
The studio's can get freezing cold, AC blowing constant cold air. All the lockable cupboards seem to be always taken people obviously hanging onto keys. Never anywhere to securely keep your stuff incase you need to pop out to the shop quickly. The card access panel to the bike area at the back via the pedestrian gate adjacent to the vehicle gate does not work for students. Keep's saying wrong zone. Have to call through the intercom via the vehicle gate to get in on a bike all the time. The menu in the Café is pretty lame at times.

47. If you have any comments about your primary work area, please feel free to provide them in the space below. This may include factors that have not been highlighted in the questions above.
Artificial lighting in studios is still a problem, sensors have failed to operate properly resulting in poor/postponed visual presentations and studio work as lights either fail to turn on and remain switched on. Also, lighting switches off when people are in the studio spaces. Sensors are supposed to detect movement and thus not deactivate lighting. No control of heating during cold climate rendering spaces non-conducive for work / uninhabitable
Artificial lighting is controlled by movement sensors but if you are working at a desk without standing up (or dancing!) it automatically switches off which is very annoying.
I do not like the way the lights go off and I have to get up and turn them back on or sit in the dark in winter apart from that the space is excellent
I find the office extrememly cold as we are forced to use air conditioning. I dislike using this and find I get more colds in this office as a result. It is not reflective of the weather or the real air tempurature.
i often need to demonstrate work on an ad hoc basis that requires projection with a high degree of contrast ratio and colour depth - a plasma is good for image quality but too

small to demonstrate menus and the like to the size of class needed. A projector is good for scale but because the lighting is too bright the subtleties of the lesson is often lost (and the pixel quality is much reduced) In circumstances where a projector could be used it would be very useful to have control over the light levels (particularly using blinds) this would make the studio spaces where i spend most of my time much more flexible and mean that there would be less need to book communal spaces (e.g. lecture theatres) for smaller groups. The studios are often too cold in the winter when heating is off. The air is too dry when heating is on. This has a very strong bearing on student attendance (and satisfaction) Often there is very heavy sound leakage into an already noisy space from the popular music course which often plays loud music in an inadequately sound-proofed room. If these issues were addressed the studios would be more useful, better frequented and student satisfaction would inevitably increase.
I suffer from working in my studio due to the design of the lighting. Strip lighting causes my eyes to flicker when studying so I spend more time at home working. I have not found a place in the building that I can work comfortably
Mac suite windows often open but locked which doesnt allow you to close them this if it is cold, it often results in them banging against the frames during windy days and allows in cold air during winter.
Main work in the Aldham Roberts Library. Silent zone on 2nd floor excellent especially as better patrolled, also ability to book a post grad desk.
My room is freezing all the time. The radiator controls appear not to work and the radiators are almost always off. This really affects me at work and makes me very cold and unhappy. I keep mentioning it to Reception and that creates occasional repairs, but the problem always occurs again very quickly.
Never enough extension sockets. (see rant on previous page) =]
Nothing on this page has any effect on the work area for a student. Whatever the conditions people will adapt. The building does what it needs too. The problem is the facilities that are on offer for students in the building - it is clear from these questions that the focus from the top management is not on getting the best out of students but showcasing a building (this is not a reflection on the tutors).
Our lecture room is studio 18. There are about 30 of us crammed in there twice a week. On a regular basis I have to leave early because the room is too stuffy, no freash air and it is March, the heating is still on.
our studio workspace is badly controlled temperature wise - either seems too hot or too cold, the lighting is too bright as too much artificial lighting has been fitted and the acoustics are bad - difficult to hear the lecturer. also the downstairs lecture room 1 is badly designed as the projector is placed too low and peoples heads get in the way of the slides.

Power sockets are the main problem, and spaces are badly organised to capitalise on the power sockets. As laptops are our primary tool, this is important. Installing extension towers is not the answer, as trailing cables and the towers themselves are still a trip hazard. Over head power as in the workshop would be the ideal solution. Studio spaces are too dark, and little light is gained from the sawtooth windows. Particularly in the post grad architecture studio there is too much of a dark area between the daylit end spaces. Tutorial/critique spaces should be acoustically isolated from the main space, and be usable on non review days. It is far too cold in winter, and from experience the warmest room is always the toilets. Background noise from the road is amplified by the building and becomes prohibitive when ventilating the spaces, particularly the lecture spaces on the third floor. There is not enough storage provision, and not enough secure storage.
The heating is poor, and the internet connection is also very poor.

70. If you have any comments about your secondary work area, please feel free to provide them in the space below. This may include factors that have not been highlighted in the questions above.
Blind is missing at the screen location from lecture theatre thus compromising visibility of images. Once repaired should not present a problem - requires urgent attention. AV system is very good when working, however, it sometimes 'disconnects' from the touch screen and becomes totally disruptive to lectures. Ensuring regular maintenance and induction to work panel is essential.
Minimal storage areas for work, more draw/cupboards could be placed with specific student temporary ownership throughout the semester
similar issue to location 1. this is a less reverberant space so most of the noise issues are caused by students and noise spillage from popular music.
The building cost millions to build. I should hope these areas were taken into account before it was built!
The library is like a youth club with people talking too much and chatting on phones
The room is always freezing and students also complain about this constantly. The air vents blow out freezing air and we have no control. I have been told by maintenance that the sensor for the temperature in this room is in a completely different and hotter part of the building which is why it thinks that this room is warm when it is not. It is very difficult to work in this room because of the exceptionally cold temperature.
The workshop is a relatively good space for the purpose, however the provision of laser cutters etc. needs to increase and improve. The wet working areas are unfit for purpose and are currently out of use. These should be accommodated within the studio spaces, or

a dedicated studio.
the workshops are quite loud and i think there should be a separate room with the laser in that blocks sound from other machinery. there should also be more machines and it should be better managed in terms of booking

71. If you have any additional comments that you would like to make about any aspect of your work environment or the building in general then please note them here. If you feel there are other aspects that contribute to the work environment or the building in general, that have not been covered in this survey, please highlight them here.
Art and Design Academy, studio spaces (for example, main G floor), architecture, sound quality in spaces is uncomfortable and very difficult to hear tutors both in tutorials and when presentations are given, some sound installations/panels in the ceiling/walls could greatly improve the space/make it much more comfortable and easier to hear.
electrical breakdowns flooding faulty doors poor lighting dangerous floor sockets
FLOOR SOCKETS ARE ILL FITTED AND POSITIONED IN WRONG PLACE FOR USE WITHIN STUDIOS AND ALSO CAN BE A TRIP / SLIP HAZARD.
Focus needs to change. I have filled in surveys about modules, tutors and now apparently about how the building works. As a building, it's a building - the focus from the top should be on making it a place to learn and develop rather than making a pretty picture.
I couldn't possibly comment.....
I feel the overall building is very beneficial to my needs of my course. There is lots of space for myself and my classmates to spread out work and work in groups or on our own. The facilities are always good and the light a fresh feel of the building stimulates my learning well
I really like the building, it is flexible enough to allow for different activities and well used
i think people should be trained to use the laser machines so they dont need any assistance and can therefore just get on with work. it is badly managed as i have been booked in for slots beyond when staff are in the workshop and hurried to leave. the bad disorganisation is affecting alot of peoples work and putting people behind with work. i think more staff should be trained to show people how to use the machines and the main technician is very unreliable and dissapears and has a bad attitute towards students - making out its a hassle to him to help student.
I think the very cold temperatures all year round need immediate attention. Also, many windows do not close as they have been badly fitted. Blinds hanging above windows often blow in the wind when the windows are closed!
Most of the teething problems that initially affected the building are being addressed and

we can see that once the remaining (important) issues have been addressed we could have a building that staff and students alike could be proud of. Unfortunately despite many attempts to justify why fitting blinds in the studio would solve the problems highlighted nothing has been actioned. Blinds would allow user-defined lighting levels at any time of day as well as helping to absorb much of the reverberation that contributes to the terrible levels of background noise in the studios. The bins smell and this contributes to poor air quality in a building with little perceived air circulation.
Office work is compromised by the annoyance that artificial lighting does not stay switched on despite personnel being in the room. One ha to stand up and switch on light manually every 20mins. This fault has been reported and despite several visits by various maintenance personnel it still has the fault. Also, self closing door to lift foyer on the third floor is faulty generating constant slamming of the door - this is highly disruptive in addition to already loud and animated conversations that take place in the lobby.
Studio 19 was a difficult place to work in when I was in there because the noise carried across the room so easily.
The acoustic levels are very bad in the postgraduate studio for architecture. It is sometimes difficult to hear someone talking next to me whereas I can hear clearly what someone is saying at the other end of the room.
The acoustics of the building are awful. Many times I have missed out of what a lecturer has said.
The entry system needs to work to improve security in the building. I appreciate it is frustrating for staff having to let people in, but if the sanctions for loss of card etc. were greater (i.e. entry were denied) this may be more condusive to an effective system. Secondary access should be provided via Brownlow Hill door, which would encourage use of the gallery space. We should have a book/stationary shop Tutorial space could be provided at the ends of the corridors by the fire escapes (in the break out spaces initially earmarked for printing), and this could be achieved with partitioning to allow more effective tutorial provision. One of the selling points when starting my course at the ADA was that students would be able to share space with other disciplines, and be inspired by those disciplines and allowing a sharing of spaces to allow complete control over which environment you want to work in... This never materialised and for me is disappointing. I feel anyone should be able to use any space in the building they should so wish, and that although I appreciate academic departments require dedicated teaching space, this should not be prohibitive to using the building as a shared resource.
The grass at the front of the building seems a waste a water feature and something exciting to do in that space would be good. =]
The prices in the tate cafe are far too high for students. The internet connection throughout the building is patchy and our area in studio 2 has a very unreliable connection. The windows in studio 2 cannot be closed so there is a constant draft. The

heating in general is not effective. There have been a number of leaks when it rains, dripping water into the studio space. Despite these issues I really like working within the building.
the studios are generally very messy, students problem but they are also quite uncomfortable spaces to work in for a long time...
There is a distinct lack of colour, a lack of art on the walls why is this? There also appears to be unhappy members of staff they look unhappy why is this?
There needs to be vending machines, or a canteen! the cafe does not have a weird variety and cannot simply get chips or a plain snadwhich chips hav to be part of a meal deal that iss still expensive it doesnt do sufficent snacks like normal crisps etc Also feel there needs to be more comfortable seating area to relax!
this questionaire had bad questiopns on it. I also use the fine art studio which I forgot to mention, around 20-25 hours per week. the air is good, lighting and equipment too.
This survey is far too much in depth, i think im the only student to fill one of these out in my studio. Main problems with all GRAPHIC ARTS studios is noise, and heating during the winter. We have no control over heating, and neither do on location staff. This is a problem, and many students don't come in during the heavy winter periods because of lack of warmth in a studio where it is reasonably expected that it should be adequately heated (or cooled) to a normal level during working hours.
too cold at the ends of the building you can feel the temp change from cold to warm to cold again sort out the hearting and the lights in studio 2 they go off too quickly when your alone in the studio
windows do not shut properly. floor sockets cintinuous danger. ongoing problems with lack of heating

Tom Reilly Building 2010

24. Please provide any comments about the communal areas of this building. This may include factors that have not been highlighted in the questions above.
10/10
A staff room would allow better integration of staff both within and between departments working in TRB. As a result of having no staff room, often staff will work through their lunch time and will thus have no break from their computer all day. the communal area provided has 3 tables which are dominated by students during term time, thus the space is rendered inappropriate for staff lunch breaks
access from entrance to UG is poor ///lighting is poor in amny rooms due to tranluscent window material ventilation is poor generally in rooms due to no opening lights
Be nice to have water coolers
Communal areas are not well known
Communal areas are rather limited in number and also in size.
Hand dryers in at least one of the toilets are set at a high only NBA players would be comfortable with.
I like to use stairs where possible but find the layout discourages this
I spend majority of my time in lectures and in labs and I do feel that both labs and lectures 'rooms' are outdated. Most lecture hall relies on the loudness of the speaker and there is no mic to be worn by the lecturer. Also the floor is not raised in the back so if people tend to sit in the back, they cant see the lecturer or the material presented. The projectors used are also a bit outdated and on a sunny day, even after pulling blinds down, it is stilla bit too pright to see everything. The labs always feels very confined. The lab is well equipped but there is a shortage of space when working in the labs. The equipments are not always put away and there is not enough storage space for equipments.
I think we need cafe or coffee machine. So, we don't have to leave the building when we only have 10 mins break or when you trying to do dissertation or any coursework write, there is no where to buy a sandwich or anything good to eat. There is a machine in the upper ground floor i think but the drinks n crisps in it cost a lot for students. Plus there isn't juice or any healthy food in it. There are no mirrors in the disabled toilets, which is somehow important! Other than that everything is fine. Thanks
I was sitting there earlier in the year and it was really cold and tables were wobbley.
It looks very clinical in some of the rooms, so maybe add a few university posters etc to make it look a bit busier. Plus, when I was there last year, the air con was on all the time,

so it was really cold and our group complained about this, as you need heat if anything in winter! Not helpful when you're sat there for 2 hours.
More drinks machines and especially access to hot drinks would be beneficial. Also the building is very hard to navigate from floor to floor if you dont want to use the lifts. I still can't get from the entrance to the 1st floor without using the lift!
More useful communal staff/PG student areas would be highly beneficial. It seems odd and unhygenic that the majority of staff take lunch at their desks due to a lack of dedicated staff room. Proper communal lunch/break areas would improve relations between staff.
Needs more seating in the existing commual areas and building does have the space for other small communal areas to be created with comfortable seating.
No security/Ga personnel ever on duty in the building. Ladies toilets on level 1 not large enough considering classroom capacity of the floor. Sinks are too low, water pressure is too high resulting in getting soaked every time you wash your hands, hand dryer in akward high position right by entry door to toilets (which opens inwards) so you risk your elbow every time you dry your hands. No ventilation inside toilets so they can often be very smelly.
Not enough communal seating areas, especially for staff only
not enough communal seating areas. there is no cafe -though there is in the buidling next door
not even space... no designated staff communal area, means SPS staff are losing community spirit and staff are not mixing with postgrads
Stairwells are always uncomfortably warm compared to other communal areas.
The building generally gives a very stark unfriendly feel.
The communial areas are poor - basically, a couple of tables and chairs in a corridor. The building needs a proper area to eat (and maybe buy) food. It at least needs a comfortable staff room. The building encourages people to lock themselves away in their offices - I use to see more people in the Henry cotton building. Staff need help interacting other than via email.
The concrete is of poor quality and is chipping away making it look older already. It looks unfinished in the areas where there is only concrete (e.g. in the stairways).
The heating can be very variable sometimes too hot and sometimes too cold at any time of the year.
the lecture romms are absolutely cold
The offices are cold all year round and the lighting in offices is too bright. There is still a lot of dust around too.

The overall quality of the building is exceptional and it is worthy of housing one of the best sport and exercise science departments in the country. However, I believe that is it let down by a lack of natural light, especially in many of the offices. This is unfortunate as in several other respects the building is ideal and definitely fit for purpose.
The toilets on the first floor are not always cleaned in a satisfactory manner. For staff working full time, on a busy floor, with no staff toilets, toilets should be cleaned during the day as well as at night. Until the walls/ceilings were sealed the concrete dust caused health problems.
There are too few communcal areas. There is hardly any social space for mixing with staff and students.
There are too few communual areas of the building - a staff room would be a great improvement.
therre are hardly any communal areas to speak of. Especially space where staff could meet or have a relatively undisturbed work break is missing. As far as I am aware there are even no so spaces on the campus at all, which adds additional demands on employees here on the campus.

47. If you have any comments about your primary work area, please feel free to provide them in the space below.
1. No mechanical ventilation within office, open and close windows and door. No grille in door so must open. 2. Can hear conversations in both adjoining offices owing to poor sound insulation. 3. Lock bolts on corridor doors noisy, loud clacking every time doors close, constantly in use through student traffic.
As an internal office there are no outside windows.
Biomechanics labs have no natural light at all.
Doors outside the office are noisy and distracting
I currently work in a windowless office, within which the air conditioning is centrally controlled so the room is always cold, as a result I have the radiator on all year round and have to dress in warm clothes even in the height of summer! There is no natural light or ventilation which effects my mood and motivation negatively.
I dont care about the quality of the air. The place is clean and secure. The building just need to update its lecture rooms, so that its not just a room to be booked but somewhere where professer can teach and students can learn effectively. We pay enough tution fee collectively for the university to be able to provide this basic need
I have been complaining about noise from the cooling bars in the ceiling for 21 months and they have not yet been fixed. When the heating is on the bars are noisy. The only

way to control the noise is to turn off the heating. This is totally unstaisfactory and affects meetings and other work.
I think we need cafe or coffee machine. So, we don't have to leave the building when we only have 10 mins break or when you trying to do dissertation or any coursework write, there is no where to buy a sandwich or anything good to eat. There is a machine in the upper ground floor i think but the drinks n crisps in it cost a lot for students. Plus there isn't juice or any healthy food in it. There are no mirrors in the disabled toilets, which is somehow important! Other than that everything is fine. Thanks
if there was more desk room to work with this would be key.
insufficient natural day light
It is a disgrace that the PhD students are confined to offices with no natural light (no windows) - these are the people who spend more time in this building than anyone else - absolutely disgraceful, especially when you consider in the building we moved from had plenty of natural light and ventilation with large windows.
My primary work area is good. A general comment about staff offices is that there is nowhere for students to sit when they're waiting for tutorial appointments. There is space at the 'security lodge end' of each of the two staff office corridors for some comfy sofas (like those in the reception or upper ground landing areas) that could be added to create student waiting areas. This would enhance the quality of the student experience. As reagards IT in the TRB teaching roooms (143, 144, 145 and 146a and b), the position of the lecterns is very problematic. If these cannot be moved so the lecturer can stand behind them, then remote hand-held devices should be provided as standard in each room to avoid having to move back and forth to progress slide presentations using the keyboard.
Office is frequently too cold. We have no control over the chill beams above us which cool the office constantly, requiring us to keep the radiator on even in the summer. Last winter we had to wear two extra layers while sitting at our desks. Lighting is far too bright and has no adjustment options.
Seethrough blackout blinds in lecture rooms could only have been installed by an idiot! In bright sunshine its hard for to students to see details of photos projected during lectures.
The blinds do not block out enough light in the end/corner lecture theatres to enable viewing of photographs during lectures.
The labs always seem to be stale, stuffy and too hot. More control over ventilation and temperature would help.
The lack of wndows is a major concern that negatively impacts health and work production. There may be the potential to change the postgraduate office with a lecture room given the greater number of hours spent by people in these rooms.

the lecture rooms are freezing
The office lights are too bright to have on but the glare from the window means I often have to shut the blind but that makes the office really dark.
The office space is fine.
The offices themselves are good - the radiator makes a noise if it is turned up - but this is a minor point. However, it does have a prison cell feel about it - maybe this a reflection of the industrial design of the building
There is a large amount of dust in my office due to it being located at a movement joint and building dust is constantly faslling out into the envioronment in my office.
This is an expectional laboratory. I have highlighted natural light as an issue in other areas but not in the labs as too much natural light in this area is actually undesirable.
Until recently office was very dusty due to unsealed concrete walls, not very inspiring to have unpainted walls in the office. The heating system is not very good as even if the radiator is turned on the two large chill beams in the office result in a cold downward draft over the desks. This happens both in winter and summer. It can make hands very cold when you are sitting still at your computer working

70. If you have any comments about your secondary work area, please feel free to provide them in the space below
1. Most labs have no outside access, windows. 2. Temperature may be too high or too low, heating system control not reliable. OK maybe 60-70% of time but very large open areas, difficult to heat/ventilate.
It would be nice to be able to dim the lights in the laboratory as this aids with the imaging techniques we use.
Lack of windows allows natural light. What windows there are are frosted, not allowing any determination of what is happening outside of the building i.e. weather, temperature, light. Rooms generally tend to be too hot with stale air (no windows that can be opened).
Not sure if you mean in TR building or not
See my comment in the previous section regarding the awkward postion of lecterns and the need for hand-held remote devices to progress presentations.
Several of the laboratory are far too hot, especially the physiology labs, to the point where they had severe adverse effects on use of the labs, there have even been incidents of people fainting due to the excessive heat
Some of the offcies are disgraceful, especially the post-graduate ones. THERE IS NO NATURAL LIGHT. This is a fundamental flaw with the building and makes it difficult to work in those rooms for long periods of time.

the teaching rooms can be chilly.
there is building work going on around the site and this is noisy but will not be a permanent feature (I hope)

71. If you have any additional comments that you would like to make about any aspect of your work environment please note them here. If you feel there are other aspects that contribute to the work environment, that have not been covered in this survey, please highlight them here.
Concerning office: The swing doors in the corridors are VERY noisy, which is very distracting when working in the office. Otherwise, congratulations to everyone who contributed to the Tom Reilly Building, as it is a great place to be a scientist/academic!
Difficult to gain entry in a rush have to fumble around trying to find student card, also dont feel safe as feel trapped inside. inside stairs unfurnished look shabby and not a good representation of the uni.
I feel that the bare concrete needs to be fixed and possibly painted. It is clearly not high quality as it is chipped in many places and was very dusty for a long time. The builiding is fantastic but this aspects detracts from the building making it look old and unfinished.
I think TRB overall provides a pleasant work environment - but there are a few things that apparently have not been thought through carefully, regarding the welfare of staff working in this building (space for undisturbed breaks), the inefficiency of some lab space (PSY) and especially the surprisingly low standard of toilets, washrooms (no hot water, no possibilty to adjust water temparature, hand driers in the wrong place) that can make it an unpleasant experience to stay for a whole working day in this building
I think we need cafe or coffee machine. So, we don't have to leave the building when we only have 10 mins break or when you trying to do dissertation or any coursework write, there is no where to buy a sandwich or anything good to eat. There is a machine in the upper ground floor i think but the drinks n crisps in it cost a lot for students. Plus there isn't juice or any healthy food in it. There are no mirrors in the disabled toilets, which is somehow important! Other than that everything is fine. Thanks
In general a bright clean and comfortable building which is mostly pleasant to work in. Let down badly by the following: 1. A major difficulty in the TRB is the lack of mobile telephone signal in most areas. Even in my office which has an outside wall reception is patchy 2-3m inside the room. For those of us who have an LJMU mobile because we move around this is a major problem. 2. Poor sound insulation between offices means that I can hear conversations in adjacent offices clearly, not only is this distracting but raises issues of privacy. 3.Other points of detail need attention: basins and hand driers in some cloakrooms are the wrong height; doorstops continually come unscrewed; door security systems are unreliable and motorised doors perform poorly; bolt system on security doors

is noisy.
It would be good to maybe have another cafe on the ground floor saving walking distance and time to get to the one in James Parson other than that just more desk space.
Overall look of the building appears unfinshed with bare concrete.
please do some thing about the freezing tempeature of the JOLT and room 137
Postgraduate office rooms are a major concern. An alternative room with windows would be preferred as per the postgraduate rooms available in the Henry Cotton building.
Temperature control in the physiology research labs is not good. The research physiology lab is constantly around 25 degrees. This is too high and should be maintained closer 18.
The bare concrete walls in much of the communal space aren't inviting
The categorization of the lower ground floor and upper ground floor can be quite confusing since the upper ground is the first floor of the building in structural terms.
The finishing is relatively poor - door handles and other fittings are already showing signs of wear and tear. The hand dryers in the toilets were installed at the wrong height - they are far too high on the walls. The sinks on the other hand are too low and the water pressure from taps is too strong. The corridor doors have the wrong handles, i.e. they do not comply with ergonomic principles - e.g. they invite one to pull when they should be pushed. The external windos are not cleaned frequently enough - they are covered in dust all year round apart from the week immediately after a window cleaning visit.
The toilets should have been re-fitted. The wash basins are too low and the hand dryer too high - annoying. Why are there pull handles on a door that need to be pushed? also annoying Interior decoration - i've still not got used to it - it feels cold and uninviting. Too much concrete
There isn't any known areas for refreshments. Lecture room needs more chairs
This building is not my main site of work but I use it for exams, lectures and seminars. I do not like the overall feeel of the building, which is quite harsh in terms of colour and lighting. The lecture rooms are echoing and the shape is not conducive to easy teaching.
Toilets have inadequate ventilation.
Very professional environment and a pleasant one to work and study in.
When you enter the buiding it is not obvious to visitors where the telephone is if they need access. The offices are very dark and univiting especially the inner ones without windows. I am only part-time but I think if I had to spend more time in the building I would find it depressing. Are there staff/communal rooms, if so I haven't found them yet.

Appendix 8

Example of Transcript DoE Interview

TITLE

Interviewee	Julia Bond
Interviewer	Mike Riley
Date	
Venue	Kingston

MR: So the first thing that I wanted to ask you really is what you understand POE to be and what it means here in Kingston

JB: yeah that might be two different things. from my perspective in theory a POE should be a comprehensive review of how the, a building has performed in terms of its technical performance, its usability, how it met the brief, how it was procured you know all, the whole process. You look at the whole project process from beginning to end and say you know you start at the beginning, and ideally you start at the beginning knowing, at the beginning you set out what you want to review at the end in an idealistic world and you look back and you look at whether, how the building has achieved that and what adjustments you might need to make to correct that particular building or improve it or whatever, or fine tune it and also to use it to inform other projects going forward if there are things that you find from that particular project that might be useful on another project

MR: ok

JB: we can't say that's necessarily how we do things

MR: how do you do things then

JB: I think we do post project reviews very well or mostly well. We are very good at the end of a project looking at the process of the project and how the project went. I think doing a full comprehensive post project review in a formal way has not been as successful as we would have liked it to have been and that's led us to think about how we would do them in the future and how we would tailor them, and we tend to only do them for big projects rather than for every project. We wouldn't do a full evaluation. We tend to do the post project thing which is much more informal, more, less data driven and more how did the project go, how's it working. And then use the, you know, the regular assessments and feedbacks from snagging and things like that to kind of close loops but we don't do anything formal

MR: right. Then you say you hadn't felt they'd been done terribly successfully what do you mean by that

JB: we felt it was important to have somebody independent from Estates doing it. On the basis that you know we might be a bit biased in terms of some of the things that might be picked up during the POA. We had an external organisation do it for us and I think we were quite disappointed with the outcome from that

MR: in what way

JB: I didn't cover everything we felt it should cover. It was very much based on the opinions and views of people who hadn't been around at the time of the projects and so was quite biased in terms of the way it was presented and it was, you know it was, there were factual errors in it which we just felt was, and I think that was the experience of getting someone coming in who knows nothing about it asking the people who are maintaining it who weren't here at the time when it was handed over even, I don't know. It just hadn't worked for us

MR: right

JB: so from that point of view we decided that it would be better in the future to do it in-house but get somebody independent to look at, just do an independent critic of the report that we do rather than necessarily do the whole thing

MR: so why do you do it at all

JB: I think the, I think the key things are knowing, learning from it because if there's something you can do better on another project you don't want to repeat the same mistakes twice. I think that bits probably the bit we tend to focus on. The second bit is we set out criteria, success criteria at the beginning of the, and this is more program rather than project. So we had a program of work that we had some criteria that we were aiming to achieve and its going back and looking at did we actually achieve at what we set out at and if not why not and then. To some extent you don't achieve that because things, in a five year project things move and, but its making sure that we monitored where we've made a decision to go a different way that you understand why you've got there

MR: Yeah

JB: and also if there are genuine reasons why we'd need to change, if we've got something wrong and its not working then you want to try and put that right. So I think those are the reasons we would do one

MR: cos actually we've talked about, well you've talked about three different things there in one sort of process almost which is , what I would terms as post project review

JB: yeah

MR: which is was it delivered on time, was it on costs, where were the major diversion points, were we haemorrhaging cash

The feed forward issue about learning from the implementation of one design and process in to another one

JB: yeah

MR: and then the I suppose satisfaction of performance in use and

JB: Yeah

MR: its almost a Soft Landings kind of thing isn't it of making a building function and for now

JB: yeah that's both in terms of a user's prospective though and also in terms of a, efficient, you know if you've got the set energy criteria for your building or whatever you know is it performing as you expected from that point of view and if not why, why not. And because that might imply there's a problem, something's not been commissioned correctly or a whole host of things that are you know if there's some fine tuning that needs to be done in terms of cushioning the systems is it users not using buildings properly. Buildings these days are not, not necessarily easy to

MR: no

JB: use you know they require an element of co-operation from the people that live in them

MR: so which model, I noticed you put the AUDE pack

JB: we don't use the AUDE one. We looked at it and just felt that it was quite bureaucratic and quite a lot to it for what we were getting, and quite formal in terms of the way it went. What we've done is, for the next one we're about to do, and as I say we only do it on big projects is we've kind of taken this as a basis and then adapted it and said well we will do these elements of it and this is how we'll share them out so you know Estates will do some bits, our Services organisation will do some of the monitoring of the data. Now we're looking at this with the benefit of hindsight and we didn't necessarily stipulate all of the criteria at the beginning so it might not be possibly to necessarily go back and verify everything

MR: right

JB: cos you know somethings, I don't know but I'm saying that's a possibility because we didn't set out in the beginning the criteria we were going to measure it by so its possible that when we look at those you won't necessarily be able to merit that

MR: I mean one of the things that that model and other models do is they try and assess user satisfaction and question eight of that survey says in broad

terms how satisfied are you with the building or something like that But a lot of what it actually measures is technical stuff like you've spoken about, you know energy measurements and performance criteria against technically defined performance criteria.

JB: yeah there are two different strands to it

MR: yeah. How important to you is the user satisfaction bit

JB: errr quite important but user satisfaction is highly subjective its very important I understand why the users are satisfied is very important because ultimately that's what makes a difference but its subjective. You could, two different people having exactly the same experience will have different views. Time makes a difference, at the point at which you ask the questions will make a difference. And probably other things that I can't think of the top of my head but its, so it is but we do but that's one of the first things that we do. When we do the post project reviews we one of the first things we do is ask the users what their experience of it has been and what their issues are and that's quite directly after they've had it so it tends to be the immediate snagging type issues. we go back and probably more informally on many projects you get feedback on what they users perceptions are and that just, I don't think you always need to go down a formal route to do it, particularly on some of the smaller projects because we work quite closely with our faculties and departments anyway you tend to know if a projects worked well and we regularly speak to them and ask them how things are going and you know quite often there's a subsequent project so you're learning from well that worked well and this bit worked well but actually that doesn't work quite how we thought it would

MR: when you do your sort of hybrid model

JB: yeah

MR: that you're using, how do you actually gather the data. Is it through questionnaires, interviews, focus groups

JB: last time it was through individual interviews. This time I think we are proposing and I haven't got it with me I should have checked that, I think we are proposing focus groups

MR: right

JB: and possibly and questionnaires, a combination

MR: right. The reason I said that question is cos the interviews in the focus groups they're very qualitative aren't they the questionnaires when you add all the results up are very quantitative and I just wonder what your view is over, about the qualitative quantitative data and which of those gives you more

JB: personally I think qualitative gives you much more because that gives you the real nub. But the way I think we've looked at doing it is we'll do the questionnaire first to, to get some pointers but then we'll do the focus groups with the results of the questionnaire to get to the nub of what the issues might be. Because I don't, but qualitative is very nice for doing analytical, sorry quantitative

MR: yeah

JB: is very nice for doing analytical stuff but getting a, you can spend an awful lot of time getting a questionnaire designed in the right way that you'll actually get the answers that you want I don't find they work, different people would just score it differently based on their perceptions. You don't get any

MR: I think, I've just been at **** this morning as I said and *******is your equivalent there, had a view which was that that the questions in this say is it too hot, is it too cold

JB: yeah

MR: is there too much glare is there too much draught

JB: yeah

MR: and his view on that was sort of, an I'm paraphrasing now, sort of well that's nice and everything but it doesn't matter because if the trend system tells us its between 19 and 21 degrees Celsius and that's what its going to be so and everyone's going to be either more or less comfortable with thatand it's the same with light the technical parameters in which the building runs kind of overrides a lot of these things so what's the point of asking people, which is interesting

JB: I don't know, what we haven't done is design our questionnaire yet and I'm not sure those are the questions that we will be asking them

MR: which leads me on to the next question I had down here which is what are the things that you think are important to people

JB: I think from our perspective it would be more how the space works from a functional point of view does it achieve you know if their job is to get students to hand in their course work, is it fulfilling that function, you know its how does it work against the function that it was designed to do

MR: right

JB: I think that's where I think you get more value out of it cos the too hot too cold thing that's back to different people have different perceptions of what's hot and cold and I don't see the value, I would agree with that view that that's not the sort of question that I would be asking because its, its too subjective. Its down to individual peoples preferences and I don't think we, you know what you

get out of it, what you do get out of it is how is a space working in comparison to how you anticipated it would work for you and what are the issues that you may have found to do with more, the design and configuration of the space as a working environment and how how people may have used things differently to what you anticipated because of the way you've configured something because that can again, there may be some things that need to be addressed or, and particularly when you're looking at future projects those are things that you can bear in mind and think well actually you'd have to think about that next time around. And then quite often it is, what I'm looking for in these sorts of things are the things that aren't obvious and if you don't stand back and ask the questions, that you're not going, you wouldn't necessarily find out. But we haven't designed the question yet so

MR: who will you report your findings to when you've done it

JB: it will go on, because of the size we're doing it on it will go at least to our infrastructure group which is a sub committee of the board of governors

MR: right. The reason I say this is because in one or two places that I've been it seems to be driven more by a procedure audit process requirement than a technical output sort of requirement so some

JB: right

MR: places that shall remain nameless have said to me well the reason we do this is because our audit committee would like to see that we're doing something systematically to review our projects and one of the outcomes of that is that the post project review bit of it is very dominant and the user satisfaction bit of it is sort of subservient to that

JB: yes

MR: what, where how, where do you think that balance would be here

JB: I would, well as I started off at the beginning, I think the post project reviews we do most of the time and we have been picked up on it by our audit department in the past. For me personally that's not what drives it, I've always done them and always I think its more about what you can learn out of them rather than necessarily going back over and critiquing what you've done its what you can take forward on to the next, cos that projects been done and delivered

MR: yeah

JB: its what you can take on it to the next project and making sure you don't fall through the same pitfalls time and time again. So I think it is heavily dominated by that and as I say on smaller projects in its the user side of it is picked up more informally rather than formally I would say

MR: but, but what is it that triggers whether or not you will do something about what's comes out of it. Is there, cos some, some of these things undoubtedly get done and then sit on a shelf

JB: yeah

MR: or as I use as proper sort of mechanisms for change. I just wondered what your view is

JB: the one we did before as I say we weren't very satisfied with the outcome so I don't think anything really, there were a couple of things, and I can't remember off the top of my head what they were but there were a couple of specific things to do with the back on the technical side of it which we obviously did follow up then and look in to try and resolve those so there were a couple of things but largely it was, I didn't find it particularly helpful. I think it just depends. Its difficult to say generically. It depends what comes out of it as to whether its something that you need to do

MR: umm

JB: I mean if you've designed something and its really not working then clearly we have to go back and correct it. But I mean that tends to come out, rather than through a formal review process, that tends to come through the normal course of events anyway you know where we have had issues on projects and we've had to go back to its not a review process that will have picked that up

MR: no I mean what what do you think about the time or the timeline at which you do these things

JB: I think it needs to be a year after you've had operate, I think you need to have experienced a full cycle of events

MR: umm

JB: people need to have got over the initial hiccups, the initial change that they go through when they move from one space in to another and there may be changes in the way they're working that they have to get used to. So I think you need to go through all of that and I think you do need a full cycle to understand what's really working and what isn't working

MR: do, I mean do you think that where they've come from is significant in how they view the new or the refurbished building

JB: Probably

MR: the reason I say that

JB: there's a change, there's a whole aspect of change management in projects that tends to go overlooked

MR: and I just wonder whether we capture that

JB: I don't think we do particularly. Not for, certainly not formally

MR: Umm

JB: I don't think we do, no probably not realistically. I think, I think in an ideal world I think you would because you capture what they're doing now and then you'd use that to assess whether you're going back to. You do that in bits, because when you're looking at defining a brief when you are building your you know half the time you're looking at what are the problems with the existing buildings

MR: yeah

JB: and what are we trying to achieve. So you address it partly but you don't necessarily address the cultural side of that in terms of how people feel about the space that they work in

MR: yeah

JB: and how you address that

MR: as I said I'm trying to get sort of a handle on what

JB: yeah

MR: what, what it is that people do think is important in terms of space and I'm running some focus groups with building users around the place as well

JB: yeah

MR: students and staff, and it will be interesting to see whether

JB: they'll have different views yeah of course

MR: what they say is the same as what you think. If you could improve either the application or the process of POE how would you

JB: Its difficult to say at the moment because I think we're still in the early stages of you know having had a bad experience and now trying to roll it out. So, I think it needs to be simple. Too many you know a book full of forms and guidance is too complicated and I think it needs to be something really straightforward that focuses on the key issues, because you want to get some benefit out of it. And I'm sure with, if you know if you looked around the people that have done it there are probably common things that come, common areas to focus on

MR: umm

JB: and nobody's got the time or the resources to do all of these things in text book fashion starting right at the beginning and going through right to the end so I think having something that's simple and I use the word value for money that you know you put the appropriate amount of time in it but you know, that will focus on the areas where you're most likely to get something out of it and therefore be able to make something

MR: the value for money things an interesting one. How much is a POE to cost do you think, to do

JB: I have no idea, if you follow the letter of that, a lot

MR: figures of £20,000 are kicked around quick commonly I think

JB: yeah I would say easily if you were going to do, if you were going to the letter, I'd be amazed if anybody had done that to the letter for £20,000 actually

MR: I mean I think its just, and I'd be interested on your views really about whether the post project review bit and the user satisfaction bit actually sit comfortably together within one process because that's, they are in that, in one process. Or whether they ought to be done separately and considered as two separate things

JB: erm to me that's just a conceptual thing, it is two things whether its part of the same process or part of a different process its

MR: yeah, that's a good answer actually. Ok and that really is pretty much everything I needed to take from you if that's ok. This won't be published this work

JB: I think though, I would, I certainly wouldn't say I was dead against it, I think we should do something. I firmly believe that because otherwise you never learn and you never you know you never know if you're doing the right thing. But I just think it has to be in a way that's manageable and meaningful

MR: I think that is the problem with not just that model but lots of the models

JB: yes

JB: yeah. Its very much, I think we were going to do a really short questionnaire just to narrow down what we'd targeted in the focus groups but that, we weren't planning to use that data particularly it was more to make sure that the focus groups were

MR: focused appropriately

JB: right, we get the right people

MR: yeah

JB: to it and that yeah that we pick on the key issues that have come out rather than have a free for all so that we actually really keep the time down to a manageable

MR: its very useful as well to have an external, or an independent facilitator for those

JB: and that's the bit we, cos as I said we said we'd do most of it ourselves but there's a couple of bits where we've just said we'll get somebody external in just to do that. A do the facilitation and B then we'll write, we'll do all the write

up but we'll get them to then just check that they've written up what they actually facilitated so it keeps it, the external stuff down to a minimum but

MR: ok well thank you ever so

Appendix 9

Examples of Outputs for Statistical Tests Relating to Application of the AUDE Questionnaire
(undertaken Using SPSS)

Kolmogorov-Smirnov and Shapiro-Wilk Tests of Normality

ADA 2010

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Q8	.132	57	.015	.936	57	.005
Q9	.253	57	.000	.839	57	.000
Q10a	.160	57	.001	.921	57	.001
Q10b	.142	57	.006	.925	57	.002
Q10c	.151	57	.002	.931	57	.003
Q10d	.172	57	.000	.926	57	.002
Q10e	.165	57	.001	.915	57	.001
Q11	.330	57	.000	.679	57	.000
Q12	.281	57	.000	.787	57	.000
Q13	.308	57	.000	.768	57	.000
Q14	.217	57	.000	.837	57	.000
Q15	.230	57	.000	.799	57	.000
Q16	.269	57	.000	.844	57	.000
Q17	.220	57	.000	.846	57	.000
Q18	.148	57	.003	.910	57	.000
Q19	.175	57	.000	.920	57	.001
Q20	.244	57	.000	.900	57	.000
Q21	.272	57	.000	.899	57	.000
Q22	.287	57	.000	.841	57	.000
Q23	.258	57	.000	.877	57	.000

a. Lilliefors Significance Correction

ADA 2012

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Q8	.208	40	.000	.895	40	.001
Q9	.244	40	.000	.843	40	.000
Q10a	.155	40	.016	.919	40	.007
Q10b	.152	40	.021	.917	40	.006
Q10c	.145	40	.033	.912	40	.004
Q10d	.186	40	.001	.878	40	.000
Q10e	.168	40	.006	.906	40	.003
Q11	.299	40	.000	.688	40	.000
Q12	.375	40	.000	.588	40	.000
Q13	.437	40	.000	.544	40	.000
Q14	.296	40	.000	.824	40	.000
Q15	.250	40	.000	.818	40	.000
Q16	.316	40	.000	.713	40	.000
Q17	.262	40	.000	.772	40	.000
Q18	.191	40	.001	.887	40	.001
Q19	.186	40	.001	.931	40	.018
Q20	.331	40	.000	.799	40	.000
Q21	.265	40	.000	.854	40	.000
Q22	.321	40	.000	.787	40	.000
Q23	.342	40	.000	.798	40	.000

a. Lilliefors Significance Correction

TRB 2010

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Q8	.236	95	.000	.856	95	.000
Q9	.283	95	.000	.772	95	.000
Q10a	.194	95	.000	.869	95	.000
Q10b	.218	95	.000	.874	95	.000
Q10c	.194	95	.000	.881	95	.000
Q10d	.157	95	.000	.917	95	.000
Q10e	.191	95	.000	.907	95	.000
Q11	.197	95	.000	.842	95	.000
Q12	.186	95	.000	.909	95	.000
Q13	.190	95	.000	.877	95	.000
Q14	.295	95	.000	.722	95	.000
Q15	.246	95	.000	.838	95	.000
Q16	.248	95	.000	.866	95	.000
Q17	.253	95	.000	.827	95	.000
Q18	.262	95	.000	.900	95	.000
Q19	.278	95	.000	.853	95	.000
Q20	.267	95	.000	.857	95	.000
Q21	.279	95	.000	.866	95	.000
Q22	.322	95	.000	.821	95	.000
Q23	.272	95	.000	.855	95	.000

a. Lilliefors Significance Correction

TRB 2013

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Q10a	.224	43	.000	.837	43	.000
Q10b	.193	43	.000	.910	43	.003
Q10c	.180	43	.001	.930	43	.012
Q10d	.186	43	.001	.930	43	.012
Q10e	.181	43	.001	.945	43	.038
Q11	.138	43	.039	.918	43	.005
Q12	.186	43	.001	.921	43	.006
Q13	.165	43	.005	.893	43	.001
Q14	.195	43	.000	.863	43	.000
Q15	.185	43	.001	.912	43	.003
Q16	.153	43	.013	.908	43	.002
Q17	.181	43	.001	.945	43	.038
Q18	.138	43	.039	.918	43	.005
Q19	.186	43	.001	.921	43	.006
Q20	.165	43	.005	.893	43	.001
Q21	.195	43	.000	.863	43	.000
Q22	.185	43	.001	.912	43	.003
Q23	.153	43	.013	.908	43	.002

a. Lilliefors Significance Correction

Chronbach's Alpha Test for Reliability

		Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Art & Design Academy	Bipolar satisfaction	.673	.645	15
	Satisfaction	.733	.750	15
Art & Design Academy 2012	Bipolar satisfaction	.592	.593	15
	Satisfaction	.706	.756	15
Tom Reilly	Bipolar satisfaction	.509	.502	16
	Satisfaction	.493	.483	15
Tom Reilly 2012	Bipolar satisfaction	.047	.096	15
	Satisfaction	.730	.736	15

Mann Whitney U-Test of Independence: Gender & Overall Satisfaction

	Gender	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)	Exact Sig. [2* (1-tailed Sig.)]
Art & Design Academy 2010	Male	24	29.88	717.00	375.000	936.000	-.345	.730	
	Female	33	28.36	936.00					
Art & Design Academy 2012	Male	13	18.23	237.00	146.000	237.000	-.869	.385	.407[b]
	Female	27	21.59	583.00					
Tom Reilly 2010	Male	48	47.19	2265.00	1089.000	2265.000	-.299	.765	
	Female	47	48.83	2295.00					
Tom Reilly 2012	Male	20	20.68	413.50	203.500	413.500	-.658	.511	
	Female	23	23.15	532.50					

Kruskall- Wallis Analysis of Variance: Occupant Group

	Occupation	ADA 2010		ADA 2012		TRB 2010		TRB 2013	
		N	Mean Rank	N	Mean Rank	N	Mean Rank	N	Mean Rank
Q8	Administrative Staff	1	5.00	4	14.63	5	52.50	3	28.83
	Researcher	2	36.25	1	27.50	12	41.17	5	15.60
	Academic Staff	7	28.93	11	16.00	15	41.17	31	23.37
	Student	44	29.68	21	22.07	56	49.87	1	24.00
	Technical Staff	2	5.00	2	27.25	6	49.75	3	11.00
	Total	56		39		94		43	
Q9	Administrative Staff	1	2.00	4	7.38	5	31.50	3	30.50
	Researcher	2	33.50	1	32.50	12	48.13	5	19.30
	Academic Staff	7	37.07	11	17.00	15	35.43	31	22.39
	Student	44	28.55	21	24.93	56	55.43	1	19.50
	Technical Staff	2	5.75	2	3.75	6	15.75	3	14.83
	Total	56		39		94		43	
Q10a	Administrative Staff	1	51.50	4	18.88	5	31.10	3	19.50
	Researcher	2	19.00	1	3.00	12	55.46	5	20.10
	Academic Staff	7	43.71	11	23.27	15	38.20	31	22.95
	Student	44	27.09	21	19.00	56	51.13	1	24.50
	Technical Staff	2	4.25	2	23.25	6	34.67	3	17.00
	Total	56		39		94		43	
Q10b	Administrative Staff	1	52.00	4	27.38	5	46.60	3	36.83
	Researcher	2	13.75	1	15.50	12	44.71	5	15.90
	Academic Staff	7	32.57	11	21.32	15	34.97	31	22.18
	Student	44	27.60	21	18.14	56	54.87	1	31.50
	Technical Staff	2	37.00	2	19.75	6	16.42	3	12.33
	Total	56		39		94		43	
Q10c	Administrative Staff	1	53.00	4	21.00	5	50.40	3	23.67
	Researcher	2	13.75	1	15.00	12	39.42	5	25.90
	Academic Staff	7	33.00	11	23.18	15	40.47	31	21.79
	Student	44	27.66	21	18.33	56	54.20	1	35.00
	Technical Staff	2	33.75	2	20.50	6	16.33	3	11.67
	Total	56		39		94		43	
Q10d	Administrative Staff	1	53.00	4	22.75	5	44.30	3	15.67
	Researcher	2	14.50	1	18.00	12	43.88	5	16.50
	Academic Staff	7	34.00	11	16.09	15	42.37	31	23.32
	Student	44	27.30	21	20.29	56	53.18	1	29.00
	Technical Staff	2	37.50	2	34.00	6	17.25	3	21.50
	Total	56		39		94		43	
Q10e	Administrative Staff	1	53.50	4	18.00	5	44.00	3	23.67
	Researcher	2	11.50	1	21.50	12	46.88	5	17.90
	Academic Staff	7	27.57	11	14.91	15	34.00	31	22.50
	Student	44	29.75	21	22.17	56	52.89	1	22.00
	Technical Staff	2	8.75	2	28.50	6	35.08	3	22.00
	Total	56		39		94		43	
Q11	Administrative Staff	1	40.00	4	20.00	5	54.20	3	28.67
	Researcher	2	40.00	1	3.50	12	55.46	5	18.60
	Academic Staff	7	33.71	11	20.77	15	43.20	31	21.35
	Student	44	26.86	21	20.38	56	46.92	1	19.00
	Technical Staff	2	29.00	2	20.00	6	42.17	3	28.67
	Total	56		39		94		43	
Q12	Administrative Staff	1	43.00	4	16.00	5	55.30	3	33.50
	Researcher	2	33.50	1	26.00	12	60.38	5	28.80
	Academic Staff	7	29.93	11	17.82	15	31.40	31	19.73
	Student	44	28.44	21	21.05	56	49.54	1	22.00
	Technical Staff	2	12.50	2	26.00	6	36.42	3	22.67

	Total	56		39		94		43	
Q13	Administrative Staff	1	42.00	4	14.50	5	60.20	3	35.83
	Researcher	2	31.50	1	24.50	12	61.63	5	21.60
	Academic Staff	7	36.00	11	17.41	15	42.30	31	21.18
	Student	44	26.73	21	21.76	56	46.10	1	18.50
	Technical Staff	2	31.50	2	24.50	6	34.75	3	18.50
	Total	56		39		94		43	
Q14	Administrative Staff	1	2.00	4	9.50	5	24.10	3	27.83
	Researcher	2	47.00	1	20.50	12	41.71	5	36.00
	Academic Staff	7	22.50	11	14.77	15	31.43	31	19.27
	Student	44	30.42	21	25.05	56	55.00	1	11.50
	Technical Staff	2	2.00	2	16.50	6	48.75	3	24.50
	Total	56		39		94		43	
Q15	Administrative Staff	1	6.50	4	11.50	5	33.80	3	36.33
	Researcher	2	45.00	1	31.50	12	46.04	5	30.10
	Academic Staff	7	30.64	11	21.86	15	40.30	31	18.61
	Student	44	29.10	21	20.43	56	52.96	1	19.50
	Technical Staff	2	2.25	2	16.50	6	28.92	3	30.00
	Total	56		39		94		43	
Q16	Administrative Staff	1	51.00	4	25.88	5	63.40	3	17.50
	Researcher	2	37.50	1	27.50	12	58.96	5	22.00
	Academic Staff	7	39.64	11	23.95	15	46.07	31	21.74
	Student	44	25.90	21	16.05	56	43.11	1	34.50
	Technical Staff	2	26.50	2	24.25	6	55.92	3	25.00
	Total	56		39		94		43	
Q17	Administrative Staff	1	10.00	4	10.38	5	47.10	3	34.50
	Researcher	2	24.50	1	30.00	12	52.21	5	28.00
	Academic Staff	7	25.71	11	16.86	15	44.37	31	21.10
	Student	44	30.10	21	24.12	56	47.96	1	2.00
	Technical Staff	2	16.25	2	8.25	6	41.92	3	15.50
	Total	56		39		94		43	
Q18	Administrative Staff	1	54.00	4	16.88	5	21.30	3	20.00
	Researcher	2	44.25	1	27.00	12	46.29	5	13.60
	Academic Staff	7	11.57	11	19.18	15	51.33	31	23.13
	Student	44	30.30	21	20.00	56	48.96	1	28.00
	Technical Staff	2	19.75	2	27.25	6	48.50	3	24.33
	Total	56		39		94		43	
Q19	Administrative Staff	1	51.00	4	22.00	5	10.80	3	20.00
	Researcher	2	35.00	1	26.50	12	43.46	5	21.40
	Academic Staff	7	27.36	11	16.64	15	44.77	31	21.42
	Student	44	28.65	21	20.05	56	51.67	1	37.50
	Technical Staff	2	11.50	2	30.75	6	54.08	3	25.83
	Total	56		39		94		43	
Q20	Administrative Staff	1	4.00	4	18.63	5	35.50	3	25.50
	Researcher	2	39.00	1	35.50	12	46.04	5	24.50
	Academic Staff	7	17.93	11	15.59	15	34.47	31	21.48
	Student	44	31.38	21	21.90	56	51.91	1	25.50
	Technical Staff	2	4.00	2	19.25	6	51.83	3	18.50
	Total	56		39		94		43	
Q21	Administrative Staff	1	56.00	4	26.38	5	23.70	3	23.50
	Researcher	2	28.50	1	5.50	12	49.21	5	19.80
	Academic Staff	7	23.07	11	22.68	15	48.97	31	21.47
	Student	44	28.17	21	17.60	56	46.22	1	23.50
	Technical Staff	2	41.00	2	25.00	6	72.17	3	29.17
	Total	56		39		94		43	
Q22	Administrative Staff	1	43.50	4	27.25	5	58.80	3	21.33
	Researcher	2	32.75	1	19.00	12	33.92	5	12.90
	Academic Staff	7	26.57	11	17.77	15	42.80	31	23.79
	Student	44	28.49	21	19.14	56	53.91	1	30.00
	Technical Staff	2	23.75	2	27.25	6	17.17	3	16.67

	Total	56		39		94		43	
Q23	Administrative Staff	1	39.00	4	14.63	5	50.30	3	21.17
	Researcher	2	29.00	1	14.00	12	57.13	5	26.90
	Academic Staff	7	23.29	11	18.36	15	39.87	31	21.48
	Student	44	29.16	21	21.74	56	44.79	1	13.50
	Technical Staff	2	26.50	2	24.50	6	70.25	3	22.83
	Total	56		39		94		43	

Descriptive Statistics

	ADA 2012			ADA 2010			TRB 2010			TRB 2013		
	N	Mean	Std.	N	Mean	Std.	N	Mean	Std.	N	Mean	Std.
Q3	40	4.48	1.109	57	4.00	1.309	95	3.44	1.743	43	4.60	2.342
Q4	40	2.90	1.411	57	2.93	1.334	95	3.06	1.398	43	3.81	1.776
Q5a	40	2.75	2.284	12	1.25	.452	95	3.23	2.769	43	5.30	2.940
Q5b	40	2.28	1.154	57	1.70	1.647	95	1.99	.844	43	2.09	1.250
Q5c	40	1.05	.221	57	1.77	1.570	95	2.16	1.461	43	1.88	1.199
Q6ai	29	4.07	2.506	57	1.18	.805	39	1.62	.747	43	-3.81	5.382
Q6bi	10	2.60	1.350	57	1.14	.441	25	1.16	.374	43	-5.70	4.813
Q6ci	6	2.33	1.506	33	4.24	2.151	24	1.17	.381	43	-6.44	4.415
Q7a	40	5.75	2.519	18	2.11	1.605	95	5.78	2.189	43	4.63	2.310
Q7b	40	4.40	2.307	8	1.00	.000	95	5.91	1.745	43	4.79	2.122
Q7c	40	7.22	2.032	57	6.18	2.376	95	6.49	1.570	43	6.16	2.069
Q7d	40	5.20	2.366	57	4.91	1.683	95	7.17	1.849	43	6.42	2.621
Q7e	40	6.38	2.559	57	7.18	1.843	95	7.39	1.776	43	7.23	2.147
Q7f	40	6.85	2.359	57	5.09	1.976	95	7.42	1.760	43	7.67	1.492
Q8	40	4.72	1.826	57	4.47	1.965	95	5.41	1.692	43	3.86	1.597
Q9	40	5.20	1.829	57	5.89	2.242	95	6.17	1.038	43	5.12	1.418
Q10a	40	4.35	1.916	57	6.74	2.066	95	3.14	1.998	43	3.12	2.259
Q10b	40	4.60	1.851	57	7.21	1.897	95	5.21	1.675	43	4.70	1.833
Q10c	40	4.55	1.961	57	4.63	1.654	95	4.92	1.860	43	4.63	1.496
Q10d	40	4.95	1.853	57	5.26	1.828	95	4.63	1.787	43	4.35	1.703
Q10e	40	4.77	1.641	57	4.67	1.776	95	4.37	1.857	43	4.02	1.504
Q11	40	6.30	1.043	57	4.60	1.731	95	5.47	1.610	43	5.07	1.653
Q12	40	6.37	1.192	57	4.25	1.786	95	5.06	1.583	43	4.74	1.747
Q13	40	6.57	.874	57	4.49	1.764	95	5.49	1.383	43	5.00	1.690
Q14	40	5.37	1.675	57	4.54	1.712	95	6.28	.975	43	5.79	1.186
Q15	40	5.92	1.185	57	6.21	1.264	95	5.52	1.398	43	5.12	1.434
Q16	40	4.70	.966	57	6.00	1.239	95	4.51	1.020	43	4.37	.817
Q17	40	6.07	1.163	57	6.16	1.082	95	5.69	1.345	43	5.79	1.355
Q18	40	2.95	1.663	57	5.63	1.410	95	4.02	1.329	43	3.40	1.330
Q19	40	4.53	1.240	57	5.84	1.386	95	4.42	1.293	43	4.05	1.112
Q20	40	3.68	1.207	57	4.44	1.102	95	4.33	1.026	43	3.67	.969
Q21	40	4.10	1.128	57	5.53	1.501	95	4.22	1.044	43	3.93	.737
Q22	40	4.05	.677	57	3.42	1.870	95	3.53	1.344	43	3.16	1.233
Q23	40	4.55	.959	57	4.70	1.636	95	4.73	1.216	43	4.72	1.054
Q25	40	2.52	1.320	57	3.67	1.393	95	1.95	.880	43	1.30	.599
Q26	40	3.77	2.154	57	4.00	1.150	95	3.39	2.033	43	3.42	1.842
Q27	40	4.78	1.441	57	4.19	1.060	95	4.86	1.589	43	4.28	1.453
Q28	40	4.47	1.037	57	4.54	1.166	95	4.45	1.070	43	4.65	1.044
Q29	40	5.53	1.339	57	4.26	2.126	95	5.25	1.480	43	5.33	1.523
Q30	40	4.30	1.604	57	3.86	1.977	95	4.55	1.939	43	4.14	1.781
Q31	40	3.32	2.068	57	4.70	1.603	95	3.05	2.180	43	3.47	2.404
Q32	40	5.05	1.894	57	4.30	1.068	95	3.65	2.128	43	4.16	1.864
Q33	40	3.35	1.875	57	5.16	1.645	95	4.02	1.368	43	3.70	1.389
Q34	40	4.32	1.403	57	4.47	1.853	95	4.23	1.410	43	4.05	1.344
Q35	40	2.28	1.921	57	3.30	1.762	95	2.85	2.083	43	4.12	2.270
Q36	40	3.88	2.209	57	5.05	1.940	95	2.98	1.995	43	3.44	2.027
Q37	40	3.02	1.747	57	3.26	1.987	95	2.94	1.972	43	3.40	2.037

Q38	40	3.78	2.044	57	4.67	1.651	95	2.83	1.831	43	3.67	1.886
Q39	40	4.25	2.329	57	2.12	1.536	95	3.34	2.040	43	3.95	2.070
Q40	40	3.72	1.320	57	4.37	2.257	95	3.53	1.465	43	3.02	1.472
Q41	40	4.38	1.192	57	3.67	2.030	95	3.76	1.596	43	3.88	1.546
Q42	40	4.13	1.453	57	4.12	1.992	95	4.92	1.226	43	4.91	1.288
Q43	40	4.43	1.152	57	4.23	1.964	95	4.36	1.081	43	4.53	1.297
Q44	40	5.65	2.434	57	3.79	1.221	95	5.78	1.947	43	5.93	1.944
Q45	40	4.45	2.438	57	4.04	1.253	95	3.98	2.231	43	4.49	2.164
Q46	40	6.28	2.000	57	4.04	1.336	95	6.41	1.641	43	6.42	1.955
Q48	40	3.95	2.342	57	4.21	1.098	95	4.44	2.319	43	4.05	2.299
Q49	25	3.88	2.027	57	6.19	2.004	56	3.46	1.954	43	-.86	6.194
Q50	24	4.79	1.641	57	4.32	2.123	53	4.62	1.655	43	-.16	6.619
Q51	21	4.48	.981	57	6.25	2.029	51	4.20	.980	43	-.74	6.444
Q52	22	4.91	1.630	57	5.88	3.196	48	5.63	1.453	43	-.35	7.158
Q53	21	4.00	1.643	32	3.97	1.805	46	4.39	1.856	43	-1.07	6.627
Q54	20	2.75	1.832	30	4.63	1.712	50	3.16	2.014	43	-1.74	5.794
Q55	23	4.61	2.017	30	4.67	1.295	52	3.75	2.177	43	-.37	6.579
Q56	21	3.62	1.717	30	4.97	1.691	51	3.92	1.521	43	-1.23	6.152
Q57	21	4.52	1.662	30	4.53	1.717	50	4.30	1.359	43	-.79	6.464
Q58	20	2.00	1.522	31	2.65	1.924	51	2.76	1.955	43	-1.91	5.362
Q59	21	3.48	2.316	31	4.48	2.143	52	3.12	2.006	43	-.98	6.170
Q60	20	3.25	2.425	31	4.03	1.888	52	3.00	1.899	43	-1.19	5.989
Q61	21	3.38	2.312	31	4.77	1.431	52	3.02	1.884	43	-1.33	6.171
Q62	18	4.22	2.045	30	2.20	1.901	46	3.50	1.964	43	-1.67	6.128
Q63	19	3.95	1.026	29	4.45	2.245	48	3.62	1.378	42	-1.50	6.302
Q64	19	4.05	1.224	29	3.62	2.145	48	3.79	1.254	43	-1.35	6.301
Q65	18	3.83	1.043	29	3.79	2.007	47	4.70	1.214	42	-1.55	6.564
Q66	18	4.06	.938	28	4.57	2.008	47	4.30	1.041	43	-1.47	6.478
Q67	18	5.61	2.090	28	4.14	1.557	49	6.33	1.612	43	-.05	7.764
Q68	18	2.94	2.182	28	4.36	1.545	47	4.32	2.188	43	-1.00	6.701
Q69	20	6.90	1.744	28	4.18	1.020	51	6.57	1.603	43	.07	7.579

Spearman-Rho Non-parametric Correlation

ADA 2010 Satisfaction Questions

			Q8	Q9	Q11	Q12	Q13	Q14	Q15	Q27	Q29	Q30	Q31	Q35	Q44	Q45	Q46
Spearman's rho	Q8	Correlation Coefficient	1.000	.549**	.054	.299*	.209	.422**	.161	.385**	.157	.163	.074	-.035	.041	-.038	-.010
		Sig. (2-tailed)		.000	.689	.024	.119	.001	.232	.003	.244	.226	.583	.794	.761	.781	.942
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q9	Correlation Coefficient	.549**	1.000	-.025	.310*	.181	.376**	.233	.320*	.225	.165	.006	-.232	.043	.083	-.040
		Sig. (2-tailed)	.000		.852	.019	.179	.004	.081	.015	.092	.219	.963	.083	.752	.540	.769
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q11	Correlation Coefficient	.054	-.025	1.000	.240	.300*	.246	.439**	-.050	.079	-.132	.036	-.058	.072	-.063	.225
		Sig. (2-tailed)	.689	.852		.072	.024	.065	.001	.714	.558	.327	.793	.668	.592	.643	.092
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q12	Correlation Coefficient	.299*	.310*	.240	1.000	.676**	.270*	.255	.382**	.358**	.074	-.092	-.189	.027	.251	.073
		Sig. (2-tailed)	.024	.019	.072		.000	.043	.055	.003	.006	.583	.495	.159	.842	.060	.592
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q13	Correlation Coefficient	.209	.181	.300*	.676**	1.000	.159	-.004	.124	.146	-.076	-.099	-.274*	-.045	.058	.239
		Sig. (2-tailed)	.119	.179	.024	.000		.236	.977	.358	.278	.572	.466	.039	.739	.666	.074
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q14	Correlation Coefficient	.422**	.376**	.246	.270*	.159	1.000	.576**	.364**	.271*	.248	.039	-.182	.370**	.148	.186
		Sig. (2-tailed)	.001	.004	.065	.043	.236		.000	.005	.042	.063	.772	.175	.005	.273	.165
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q15	Correlation Coefficient	.161	.233	.439**	.255	-.004	.576**	1.000	.374**	.412**	.307*	.074	-.130	.171	.101	.051
		Sig. (2-tailed)	.232	.081	.001	.055	.977	.000		.004	.001	.020	.582	.336	.204	.454	.706
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q27	Correlation Coefficient	.385**	.320*	-.050	.382**	.124	.364**	.374**	1.000	.647**	.564**	.278*	-.106	-.005	.081	-.005
		Sig. (2-tailed)	.003	.015	.714	.003	.358	.005	.004		.000	.000	.036	.435	.970	.548	.970
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q29	Correlation Coefficient	.157	.225	.079	.358**	.146	.271*	.412**	.647**	1.000	.429**	.231	-.130	.100	.258	.075
		Sig. (2-tailed)	.244	.092	.558	.006	.278	.042	.001	.000		.001	.084	.335	.457	.053	.578
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q30	Correlation Coefficient	.163	.165	-.132	.074	-.076	.248	.307*	.564**	.429**	1.000	.418**	-.103	.145	.078	-.036
		Sig. (2-tailed)	.226	.219	.327	.583	.572	.063	.020	.000	.001		.001	.447	.282	.565	.791
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q31	Correlation Coefficient	.074	.006	.036	-.092	-.099	.039	.074	.278*	.231	.418**	1.000	.409**	.148	.000	.068
		Sig. (2-tailed)	.583	.963	.793	.495	.466	.772	.582	.036	.084	.001		.002	.273	.997	.616
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q35	Correlation Coefficient	-.035	-.232	-.058	-.189	-.274*	-.182	-.130	-.106	-.130	-.103	.409**	1.000	-.091	.147	-.195
		Sig. (2-tailed)	.794	.083	.668	.159	.039	.175	.336	.435	.335	.447	.002		.502	.277	.147
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q44	Correlation Coefficient	.041	.043	.072	.027	-.045	.370**	.171	-.005	.100	.145	.148	-.091	1.000	.146	.235
		Sig. (2-tailed)	.761	.752	.592	.842	.739	.005	.204	.970	.457	.282	.273	.502		.278	.078
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q45	Correlation Coefficient	-.038	.083	-.063	.251	.058	.148	.101	.081	.258	.078	.000	.147	.146	1.000	.245
		Sig. (2-tailed)	.781	.540	.643	.060	.666	.273	.454	.548	.053	.565	.997	.277	.278		.066
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q46	Correlation Coefficient	-.010	-.040	.225	.073	.239	.186	.051	-.005	.075	-.036	.068	-.195	.235	.245	1.000
		Sig. (2-tailed)	.942	.769	.092	.592	.074	.165	.706	.970	.578	.791	.616	.147	.078	.066	
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

ADA 2010 Satisfaction (bi-polar) related questions and overall satisfaction

			Q8	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q28	Q33	Q34	Q40	Q41	Q42	Q43
Spearman's rho	Q8	Correlation Coefficient	1.000	.041	.140	.102	.006	.285*	-.096	-.055	-.209	-.107	.054	-.111	-.068	-.030	-.081	-.306*
		Sig. (2-tailed)		.765	.297	.449	.963	.032	.478	.682	.119	.427	.687	.411	.616	.824	.550	.021
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q16	Correlation Coefficient	.041	1.000	-.007	.158	.241	.134	-.082	.093	.305*	.346**	.084	.138	-.136	.122	.074	.262*
		Sig. (2-tailed)	.765		.961	.241	.070	.322	.545	.491	.021	.008	.533	.305	.313	.365	.586	.049
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q17	Correlation Coefficient	.140	-.007	1.000	.110	.193	.114	-.125	-.044	.252	-.099	.095	.236	-.124	-.031	.058	.153
		Sig. (2-tailed)	.297	.961		.414	.150	.396	.353	.747	.058	.462	.481	.077	.356	.817	.670	.256
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q18	Correlation Coefficient	.102	.158	.110	1.000	.331*	.262*	-.143	.120	.263*	-.224	.816**	.177	-.024	-.013	.057	.015
		Sig. (2-tailed)	.449	.241	.414		.012	.049	.290	.375	.048	.093	.000	.188	.858	.923	.675	.910
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q19	Correlation Coefficient	.006	.241	.193	.331*	1.000	.151	-.115	.206	.296*	.092	.342**	.692**	.064	.304*	.115	.106
		Sig. (2-tailed)	.963	.070	.150	.012		.261	.396	.124	.025	.496	.009	.000	.636	.022	.394	.434
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q20	Correlation Coefficient	.285*	.134	.114	.262*	.151	1.000	.164	.153	.122	.025	.122	.099	-.099	-.088	.097	-.114
		Sig. (2-tailed)	.032	.322	.396	.049	.261		.222	.256	.365	.852	.364	.464	.463	.516	.474	.398
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q21	Correlation Coefficient	-.096	-.082	-.125	-.143	-.115	.164	1.000	-.087	-.077	.211	-.150	-.018	.052	.045	-.005	-.181
		Sig. (2-tailed)	.478	.545	.353	.290	.396	.222		.519	.569	.115	.265	.895	.701	.741	.968	.178
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q22	Correlation Coefficient	-.055	.093	-.044	.120	.206	.153	-.087	1.000	.098	.150	.031	.363**	.272*	.272*	.074	.040
		Sig. (2-tailed)	.682	.491	.747	.375	.124	.256	.519		.469	.264	.817	.006	.041	.041	.584	.770
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q23	Correlation Coefficient	-.209	.305*	.252	.263*	.296*	.122	-.077	.098	1.000	.165	.114	.311*	-.125	.045	.456**	.507**
		Sig. (2-tailed)	.119	.021	.058	.048	.025	.365	.569	.469		.220	.399	.019	.356	.742	.000	.000
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q28	Correlation Coefficient	-.107	.346**	-.099	-.224	.092	.025	.211	.150	.165	1.000	-.197	.150	-.050	.124	.137	.119
		Sig. (2-tailed)	.427	.008	.462	.093	.496	.852	.115	.264	.220		.141	.266	.714	.359	.310	.376
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q33	Correlation Coefficient	.054	.084	.095	.816**	.342**	.122	-.150	.031	.114	-.197	1.000	.131	.183	.172	.040	.022
		Sig. (2-tailed)	.687	.533	.481	.000	.009	.364	.265	.817	.399	.141		.332	.173	.202	.770	.873
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q34	Correlation Coefficient	-.111	.138	.236	.177	.692**	.099	-.018	.363**	.311*	.150	.131	1.000	-.054	.302*	.097	.331*
		Sig. (2-tailed)	.411	.305	.077	.188	.000	.464	.895	.006	.019	.266	.332		.692	.023	.475	.012
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q40	Correlation Coefficient	-.068	-.136	-.124	-.024	.064	-.099	.052	.272*	-.125	-.050	.183	-.054	1.000	.657**	-.244	-.216
		Sig. (2-tailed)	.616	.313	.356	.858	.636	.463	.701	.041	.356	.714	.173	.692		.000	.068	.106
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q41	Correlation Coefficient	-.030	.122	-.031	-.013	.304*	-.088	.045	.272*	.045	.124	.172	.302*	.657**	1.000	-.121	.110
		Sig. (2-tailed)	.824	.365	.817	.923	.022	.516	.741	.041	.742	.359	.202	.023	.000		.370	.416
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q42	Correlation Coefficient	-.081	.074	.058	.057	.115	.097	-.005	.074	.456**	.137	.040	.097	-.244	-.121	1.000	.326*
		Sig. (2-tailed)	.550	.586	.670	.675	.394	.474	.968	.584	.000	.310	.770	.475	.068	.370		.013
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
	Q43	Correlation Coefficient	-.306*	.262*	.153	.015	.106	-.114	-.181	.040	.507**	.119	.022	.331*	-.216	.110	.326*	1.000
		Sig. (2-tailed)	.021	.049	.256	.910	.434	.398	.178	.770	.000	.376	.873	.012	.106	.416	.013	
		N	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

ADA 2010 Quality related questions and overall satisfaction

			Q7a	Q7b	Q7c	Q8
Spearman's rho	Q7a	Correlation Coefficient	1.000	.680**	.860**	.753**
		Sig. (2-tailed)	.	.000	.003	.000
		N	25	22	9	25
	Q7b	Correlation Coefficient	.680**	1.000	.891**	.664**
		Sig. (2-tailed)	.000	.	.000	.000
		N	22	52	11	52
	Q7c	Correlation Coefficient	.860**	.891**	1.000	.579
		Sig. (2-tailed)	.003	.000	.	.062
		N	9	11	11	11
	Q8	Correlation Coefficient	.753**	.664**	.579	1.000
		Sig. (2-tailed)	.000	.000	.062	.
		N	25	52	11	57

**. Correlation is significant at the 0.01 level (2-tailed).

ADA 2010 Security related factors and overall perception of security

			Q9	Q10a	Q10b	Q10c	Q10d	Q10e
Spearman's rho	Q9	Correlation Coefficient	1.000	.138	-.177	-.107	.006	.284*
		Sig. (2-tailed)	.	.305	.189	.430	.967	.032
		N	57	57	57	57	57	57
	Q10a	Correlation Coefficient	.138	1.000	.488**	.491**	.351**	.242
		Sig. (2-tailed)	.305	.	.000	.000	.007	.070
		N	57	57	57	57	57	57
	Q10b	Correlation Coefficient	-.177	.488**	1.000	.622**	.414**	.097
		Sig. (2-tailed)	.189	.000	.	.000	.001	.473
		N	57	57	57	57	57	57
	Q10c	Correlation Coefficient	-.107	.491**	.622**	1.000	.587**	.173
		Sig. (2-tailed)	.430	.000	.000	.	.000	.198
		N	57	57	57	57	57	57
	Q10d	Correlation Coefficient	.006	.351**	.414**	.587**	1.000	.487**
		Sig. (2-tailed)	.967	.007	.001	.000	.	.000
		N	57	57	57	57	57	57
	Q10e	Correlation Coefficient	.284*	.242	.097	.173	.487**	1.000
		Sig. (2-tailed)	.032	.070	.473	.198	.000	.
		N	57	57	57	57	57	57

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

ADA 2010 Satisfaction and Subscale clusters

			Q8	Q9	lightsatis	lightbipolar	accesssatis	airsatis	airbipolar	heatbipolar	heatsatis	noisebipolar
Spearman's rho	Q8	Correlation Coefficient	1.000	.549**	.025	-.248	.255	.298*	-.010	-.001	-.035	.285*
		Sig. (2-tailed)		.000	.856	.063	.055	.024	.943	.995	.794	.032
		N	57	57	57	57	57	57	57	57	57	57
	Q9	Correlation Coefficient	.549**	1.000	.105	-.214	.241	.292*	.199	.083	-.232	.395**
		Sig. (2-tailed)	.000		.436	.110	.070	.028	.139	.538	.083	.002
		N	57	57	57	57	57	57	57	57	57	57
	lightsatis	Correlation Coefficient	.025	.105	1.000	.199	.140	.225	.109	-.248	.044	.011
		Sig. (2-tailed)	.856	.436		.138	.297	.093	.420	.063	.742	.936
		N	57	57	57	57	57	57	57	57	57	57
	lightbipolar	Correlation Coefficient	-.248	-.214	.199	1.000	-.031	.151	.201	.277*	.325*	.062
		Sig. (2-tailed)	.063	.110	.138		.821	.263	.134	.037	.014	.646
		N	57	57	57	57	57	57	57	57	57	57
	accesssatis	Correlation Coefficient	.255	.241	.140	-.031	1.000	.166	.255	.114	-.176	.003
		Sig. (2-tailed)	.055	.070	.297	.821		.218	.056	.399	.190	.983
		N	57	57	57	57	57	57	57	57	57	57
	airsatis	Correlation Coefficient	.298*	.292*	.225	.151	.166	1.000	.090	-.018	-.022	.300*
		Sig. (2-tailed)	.024	.028	.093	.263	.218		.503	.897	.869	.023
		N	57	57	57	57	57	57	57	57	57	57
	airbipolar	Correlation Coefficient	-.010	.199	.109	.201	.255	.090	1.000	.166	-.021	.084
		Sig. (2-tailed)	.943	.139	.420	.134	.056	.503		.216	.874	.535
		N	57	57	57	57	57	57	57	57	57	57
	heatbipolar	Correlation Coefficient	-.001	.083	-.248	.277*	.114	-.018	.166	1.000	.101	.218
		Sig. (2-tailed)	.995	.538	.063	.037	.399	.897	.216		.454	.103
		N	57	57	57	57	57	57	57	57	57	57
	heatsatis	Correlation Coefficient	-.035	-.232	.044	.325*	-.176	-.022	-.021	.101	1.000	.025
		Sig. (2-tailed)	.794	.083	.742	.014	.190	.869	.874	.454		.854
		N	57	57	57	57	57	57	57	57	57	57
	noisebipolar	Correlation Coefficient	.285*	.395**	.011	.062	.003	.300*	.084	.218	.025	1.000
		Sig. (2-tailed)	.032	.002	.936	.646	.983	.023	.535	.103	.854	
		N	57	57	57	57	57	57	57	57	57	57

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

ADA 2012 Satisfaction Questions

			Q8	Q9	Q11	Q12	Q13	Q14	Q15	Q27	Q29	Q30	Q31	Q35	Q44	Q45	Q46
Spearman's rho	Q8	Correlation Coefficient	1.000	.493**	.028	.219	.302	.376*	.189	.297	.147	.240	.446**	.145	-.031	.346*	-.071
		Sig (2-tailed)		.001	.865	.175	.058	.017	.243	.062	.365	.135	.004	.373	.849	.029	.663
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q9	Correlation Coefficient	.493**	1.000	.003	.129	.334*	.474**	.203	.303	.457**	.171	.130	.323*	.079	.379*	-.209
		Sig (2-tailed)	.001		.986	.427	.035	.002	.210	.057	.003	.290	.424	.042	.626	.016	.195
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q11	Correlation Coefficient	.028	.003	1.000	.554**	.396*	.109	.396*	.188	-.080	-.016	.145	-.020	-.189	.371*	-.006
		Sig (2-tailed)	.865	.986		.000	.011	.503	.011	.246	.625	.923	.372	.901	.244	.018	.971
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q12	Correlation Coefficient	.219	.129	.554**	1.000	.597**	.387*	.434**	.181	.113	.232	.082	-.207	-.105	.414**	.076
		Sig (2-tailed)	.175	.427	.000		.000	.014	.005	.264	.488	.150	.613	.201	.519	.008	.640
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q13	Correlation Coefficient	.302	.334*	.396*	.597**	1.000	.461**	.385*	.420**	.382*	.167	.167	-.156	-.046	.484**	.042
		Sig (2-tailed)	.058	.035	.011	.000		.003	.014	.007	.015	.304	.304	.336	.780	.002	.798
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q14	Correlation Coefficient	.376*	.474**	.109	.387*	.461**	1.000	.468**	.423**	.326*	.284	.047	-.200	.125	.612**	-.150
		Sig (2-tailed)	.017	.002	.503	.014	.003		.002	.007	.040	.075	.774	.216	.444	.000	.355
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q15	Correlation Coefficient	.189	.203	.396*	.434**	.385*	.468**	1.000	.480**	.226	.211	-.006	-.138	.108	.525**	.030
		Sig (2-tailed)	.243	.210	.011	.005	.014	.002		.002	.160	.191	.970	.395	.507	.001	.854
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q27	Correlation Coefficient	.297	.303	.188	.181	.420**	.423**	.480**	1.000	.268	.376*	.202	.049	.098	.405**	-.018
		Sig (2-tailed)	.062	.057	.246	.264	.007	.007	.002		.094	.017	.212	.764	.549	.009	.912
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q29	Correlation Coefficient	.147	.457**	-.080	.113	.382*	.326*	.226	.268	1.000	.132	.162	.035	-.065	.266	-.110
		Sig (2-tailed)	.365	.003	.625	.488	.015	.040	.160	.094		.416	.318	.831	.690	.097	.499
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q30	Correlation Coefficient	.240	.171	-.016	.232	.167	.284	.211	.376*	.132	1.000	-.081	-.123	.004	.193	-.121
		Sig (2-tailed)	.135	.290	.923	.150	.304	.075	.191	.017	.416		.620	.449	.980	.233	.455
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q31	Correlation Coefficient	.446**	.130	.145	.082	.167	.047	-.006	.202	.162	-.081	1.000	.473**	-.032	.330*	.019
		Sig (2-tailed)	.004	.424	.372	.613	.304	.774	.970	.212	.318	.620		.002	.844	.038	.908
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q35	Correlation Coefficient	.145	.323*	-.020	-.207	-.156	-.200	-.138	.049	.035	-.123	.473**	1.000	-.237	.071	-.166
		Sig (2-tailed)	.373	.042	.901	.201	.336	.216	.395	.764	.831	.449	.002		.140	.664	.305
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q44	Correlation Coefficient	-.031	.079	-.189	-.105	-.046	.125	.108	.098	-.065	.004	-.032	-.237	1.000	.039	.446**
		Sig (2-tailed)	.849	.626	.244	.519	.780	.444	.507	.549	.690	.980	.844	.140		.810	.004

	N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Correlation Coefficient	.346*	.379*	.371*	.414**	.484**	.612**	.525**	.405**	.266	.193	.330*	.071	.039	1.000	.047
Q45	Sig (2-tailed)	.029	.016	.018	.008	.002	.000	.001	.009	.097	.233	.038	.664	.810	.	.773
	N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Correlation Coefficient	-.071	-.209	-.006	.076	.042	-.150	.030	-.018	-.110	-.121	.019	-.166	.446**	.047	1.000
Q46	Sig (2-tailed)	.663	.195	.971	.640	.798	.355	.854	.912	.499	.455	.908	.305	.004	.773	.
	N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

ADA 2012 Satisfaction (bi-polar) related questions and overall satisfaction

			Q8	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q28	Q33	Q34	Q40	Q41	Q42	Q43
Spearman's rho	Q8	Correlation Coefficient	1.000	-.161	.239	.625**	.120	.418**	-.019	.198	.058	-.013	.212	.076	.307	.119	.051	-.068
		Sig. (2-tailed)		.321	.138	.000	.460	.007	.908	.221	.722	.938	.189	.641	.054	.463	.754	.677
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q16	Correlation Coefficient	-.161	1.000	-.212	.058	.278	.026	.311	-.139	.052	.470**	.111	.175	-.111	-.172	-.220	-.179
		Sig. (2-tailed)	.321		.188	.723	.082	.874	.050	.392	.748	.002	.495	.279	.496	.287	.172	.269
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q17	Correlation Coefficient	.239	-.212	1.000	.170	.156	.264	-.183	.059	.096	.005	-.054	-.098	-.004	.020	-.241	-.278
		Sig. (2-tailed)	.138	.188		.293	.337	.100	.257	.719	.555	.976	.740	.549	.979	.904	.134	.082
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q18	Correlation Coefficient	.625**	.058	.170	1.000	.088	.460**	.137	.089	.185	.120	.675**	.085	.058	-.160	.107	.143
		Sig. (2-tailed)	.000	.723	.293		.590	.003	.401	.587	.253	.460	.000	.601	.721	.323	.511	.377
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q19	Correlation Coefficient	.120	.278	.156	.088	1.000	.220	.178	.204	.248	.148	-.103	.541**	.284	.097	.106	-.260
		Sig. (2-tailed)	.460	.082	.337	.590		.173	.273	.208	.122	.360	.525	.000	.075	.550	.515	.105
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q20	Correlation Coefficient	.418**	.026	.264	.460**	.220	1.000	-.117	.013	.105	-.094	.104	-.059	.102	-.250	-.245	.331*
		Sig. (2-tailed)	.007	.874	.100	.003	.173		.473	.938	.521	.564	.522	.718	.530	.120	.128	.037
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q21	Correlation Coefficient	-.019	.311	-.183	.137	.178	-.117	1.000	.088	.130	.280	.303	.393*	.079	-.012	.005	.199
		Sig. (2-tailed)	.908	.050	.257	.401	.273	.473		.589	.424	.080	.057	.012	.626	.940	.977	.219
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q22	Correlation Coefficient	.198	-.139	.059	.089	.204	.013	.088	1.000	.100	.178	.102	.277	.394*	.267	.042	.077
		Sig. (2-tailed)	.221	.392	.719	.587	.208	.938	.589		.541	.272	.531	.083	.012	.095	.798	.637
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q23	Correlation Coefficient	.058	.052	.096	.185	.248	.105	.130	.100	1.000	.243	.100	.145	.272	.175	.275	.221
		Sig. (2-tailed)	.722	.748	.555	.253	.122	.521	.424	.541		.130	.538	.372	.090	.281	.086	.170
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q28	Correlation Coefficient	-.013	.470**	.005	.120	.148	-.094	.280	.178	.243	1.000	.313*	.427**	-.151	-.111	-.135	.054
		Sig. (2-tailed)	.938	.002	.976	.460	.360	.564	.080	.272	.130		.049	.006	.353	.497	.407	.742
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q33	Correlation Coefficient	.212	.111	-.054	.675**	-.103	.104	.303	.102	.100	.313*	1.000	.122	-.081	-.223	.052	.219
		Sig. (2-tailed)	.189	.495	.740	.000	.525	.522	.057	.531	.538	.049		.454	.621	.166	.752	.175
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Q34	Correlation Coefficient	.076	.175	-.098	.085	.541**	-.059	.393*	.277	.145	.427**	.122	1.000	.164	.116	.100	.172
		Sig. (2-tailed)	.641	.279	.549	.601	.000	.718	.012	.083	.372	.006	.454		.311	.477	.539	.288
		N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40

Q40	Correlation Coefficient	.307	-.111	-.004	.058	.284	.102	.079	.394*	.272	-.151	-.081	.164	1.000	.535**	.232	-.008
	Sig. (2-tailed)	.054	.496	.979	.721	.075	.530	.626	.012	.090	.353	.621	.311		.000	.151	.959
	N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Q41	Correlation Coefficient	.119	-.172	.020	-.160	.097	-.250	-.012	.267	.175	-.111	-.223	.116	.535**	1.000	.143	.185
	Sig. (2-tailed)	.463	.287	.904	.323	.550	.120	.940	.095	.281	.497	.166	.477	.000	.	.379	.254
	N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Q42	Correlation Coefficient	.051	-.220	-.241	.107	.106	-.245	.005	.042	.275	-.135	.052	.100	.232	.143	1.000	.608**
	Sig. (2-tailed)	.754	.172	.134	.511	.515	.128	.977	.798	.086	.407	.752	.539	.151	.379		.000
	N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Q43	Correlation Coefficient	.068	-.179	-.278	.143	-.260	-.331*	.199	.077	.221	.054	.219	.172	-.008	.185	.608**	1.000
	Sig. (2-tailed)	.677	.269	.082	.377	.105	.037	.219	.637	.170	.742	.175	.288	.959	.254	.000	.
	N	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

ADA 2012 Quality related questions and overall satisfaction

			Q7a	Q7b	Q7c	Q8
Spearman's rho	Q7a	Correlation Coefficient	1.000	.382	.344	.737**
		Sig. (2-tailed)	.	.117	.571	.000
		N	23	18	5	23
	Q7b	Correlation Coefficient	.382	1.000	.889*	.515**
		Sig. (2-tailed)	.117	.	.018	.002
		N	18	33	6	33
	Q7c	Correlation Coefficient	.344	.889*	1.000	.813*
		Sig. (2-tailed)	.571	.018	.	.049
		N	5	6	6	6
	Q8	Correlation Coefficient	.737**	.515**	.813*	1.000
		Sig. (2-tailed)	.000	.002	.049	.
		N	23	33	6	40

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

ADA 2012 Security related factors and overall perception of security

			Q9	Q10a	Q10b	Q10c	Q10d	Q10e
Spearman's rho	Q9	Correlation Coefficient	1.000	-.375*	-.225	-.070	-.019	.222
		Sig (2-tailed)	.	.017	.162	.666	.909	.168
		N	40	40	40	40	40	40
	Q10a	Correlation Coefficient	-.375*	1.000	.664**	.575**	.337*	.132
		Sig (2-tailed)	.017	.	.000	.000	.033	.416
		N	40	40	40	40	40	40
	Q10b	Correlation Coefficient	-.225	.664**	1.000	.815**	.539**	.285
		Sig (2-tailed)	.162	.000	.	.000	.000	.075
		N	40	40	40	40	40	40
	Q10c	Correlation Coefficient	-.070	.575**	.815**	1.000	.537**	.366*
		Sig (2-tailed)	.666	.000	.000	.	.000	.020
		N	40	40	40	40	40	40
	Q10d	Correlation Coefficient	-.019	.337*	.539**	.537**	1.000	.555**
		Sig (2-tailed)	.909	.033	.000	.000	.	.000
		N	40	40	40	40	40	40
	Q10e	Correlation Coefficient	.222	.132	.285	.366*	.555**	1.000
		Sig (2-tailed)	.168	.416	.075	.020	.000	.
		N	40	40	40	40	40	40

*. Correlation is significant at the 0 05 level (2-tailed).
**. Correlation is significant at the 0 01 level (2-tailed).

ADA 2012 Satisfaction and Subscale clusters

			Q8	Q9	lightsatis	lightbipolar	accesssatis	airsatis	airbipolar	heatsatis	heatbipolar	noisebipolar
Spearman's rho	Q8	Correlation Coefficient	1.000	.493**	.209	.138	.162	.460**	.105	.145	.406**	.418**
		Sig. (2-tailed)		.001	.195	.394	.318	.003	.517	.373	.009	.007
		N	40	40	40	40	40	40	40	40	40	40
	Q9	Correlation Coefficient	.493**	1.000	.289	-.085	.183	.416**	.233	-.323*	-.023	.438**
		Sig. (2-tailed)	.001		.070	.604	.258	.008	.148	.042	.888	.005
		N	40	40	40	40	40	40	40	40	40	40
	lightsatis	Correlation Coefficient	.209	.289	1.000	.117	.254	.393*	.049	-.107	-.061	.172
		Sig. (2-tailed)	.195	.070		.474	.114	.012	.766	.511	.709	.290
		N	40	40	40	40	40	40	40	40	40	40
	lightbipolar	Correlation Coefficient	.138	-.085	.117	1.000	.032	.171	-.156	.302	.295	-.250
		Sig. (2-tailed)	.394	.604	.474		.846	.290	.337	.058	.065	.119
		N	40	40	40	40	40	40	40	40	40	40
	accesssatis	Correlation Coefficient	.162	.183	.254	.032	1.000	.358*	.179	-.174	.445**	.333*
		Sig. (2-tailed)	.318	.258	.114	.846		.023	.270	.284	.004	.036
		N	40	40	40	40	40	40	40	40	40	40
	airsatis	Correlation Coefficient	.460**	.416**	.393*	.171	.358*	1.000	.224	.128	.352*	.321*
		Sig. (2-tailed)	.003	.008	.012	.290	.023		.165	.429	.026	.043
		N	40	40	40	40	40	40	40	40	40	40
	airbipolar	Correlation Coefficient	.105	.233	.049	-.156	.179	.224	1.000	-.117	.379*	.118
		Sig. (2-tailed)	.517	.148	.766	.337	.270	.165		.471	.016	.467
		N	40	40	40	40	40	40	40	40	40	40
	heatsatis	Correlation Coefficient	.145	-.323*	-.107	.302	-.174	.128	-.117	1.000	.144	-.082
		Sig. (2-tailed)	.373	.042	.511	.058	.284	.429	.471		.375	.614
		N	40	40	40	40	40	40	40	40	40	40
	heatbipolar	Correlation Coefficient	.406**	-.023	-.061	.295	.445**	.352*	.379*	.144	1.000	.301
		Sig. (2-tailed)	.009	.888	.709	.065	.004	.026	.016	.375		.059
		N	40	40	40	40	40	40	40	40	40	40
	noisebipolar	Correlation Coefficient	.418**	.438**	.172	-.250	.333*	.321*	.118	-.082	.301	1.000
		Sig. (2-tailed)	.007	.005	.290	.119	.036	.043	.467	.614	.059	
		N	40	40	40	40	40	40	40	40	40	40

** Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

TRB 2010 Satisfaction Questions

			Q8	Q9	Q11	Q12	Q13	Q14	Q15	Q27	Q29	Q30	Q31	Q35	Q44	Q45	Q46
Spearman's rho	Q8	Correlation Coefficient	1.000	-.029	.034	-.021	-.053	.128	-.043	-.159	-.067	-.052	.030	-.095	-.163	-.069	-.184
		Sig. (2-tailed)		.780	.747	.838	.612	.218	.677	.124	.518	.618	.776	.359	.115	.507	.074
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q9	Correlation Coefficient	-.029	1.000	.213*	.252*	.358**	.351**	.400**	.274**	.179	.209*	-.126	-.058	-.054	-.186	-.067
		Sig. (2-tailed)	.780		.038	.014	.000	.000	.000	.007	.082	.042	.222	.580	.604	.072	.521
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q11	Correlation Coefficient	.034	.213*	1.000	.524**	.446**	.092	.251*	.203*	.193	.126	.024	.039	.194	.046	.131
		Sig. (2-tailed)	.747	.038		.000	.000	.378	.014	.049	.061	.223	.821	.710	.060	.657	.205
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q12	Correlation Coefficient	-.021	.252*	.524**	1.000	.628**	.240*	.319**	.118	.204*	.185	-.130	-.027	.152	-.073	.044
		Sig. (2-tailed)	.838	.014	.000		.000	.019	.002	.253	.048	.072	.208	.792	.142	.484	.670
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q13	Correlation Coefficient	-.053	.358**	.446**	.628**	1.000	.248*	.315**	.277**	.260*	.201	-.039	.002	-.010	.011	.098
		Sig. (2-tailed)	.612	.000	.000	.000		.016	.002	.007	.011	.051	.706	.986	.922	.913	.347
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q14	Correlation Coefficient	.128	.351**	.092	.240*	.248*	1.000	.362**	.165	.146	.202*	-.088	-.185	-.069	-.113	-.086
		Sig. (2-tailed)	.218	.000	.378	.019	.016		.000	.111	.158	.049	.396	.073	.504	.276	.405
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q15	Correlation Coefficient	.043	.400**	.251*	.319**	.315**	.362**	1.000	.483**	.464**	.498**	.041	.074	-.012	-.056	-.002
		Sig. (2-tailed)	.677	.000	.014	.002	.002	.000		.000	.000	.000	.690	.476	.905	.593	.983
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q27	Correlation Coefficient	-.159	.274**	.203*	.118	.277**	.165	.483**	1.000	.564**	.677**	.185	.160	-.146	.054	-.097
		Sig. (2-tailed)	.124	.007	.049	.253	.007	.111	.000		.000	.000	.072	.122	.159	.605	.348
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q29	Correlation Coefficient	-.067	.179	.193	.204*	.260*	.146	.464**	.564**	1.000	.311**	-.006	.029	-.024	.062	-.169
		Sig. (2-tailed)	.518	.082	.061	.048	.011	.158	.000	.000		.002	.956	.777	.816	.552	.101
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q30	Correlation Coefficient	-.052	.209*	.126	.185	.201	.202*	.498**	.677**	.311**	1.000	.315**	.256*	-.249*	-.037	-.153
		Sig. (2-tailed)	.618	.042	.223	.072	.051	.049	.000	.000	.002		.002	.012	.015	.721	.140
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q31	Correlation Coefficient	.030	-.126	.024	-.130	-.039	-.088	.041	.185	-.006	.315**	1.000	.757**	-.305**	.433**	-.160
		Sig. (2-tailed)	.776	.222	.821	.208	.706	.396	.690	.072	.956	.002		.000	.003	.000	.122
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q35	Correlation Coefficient	-.095	-.058	.039	-.027	.002	-.185	.074	.160	.029	.256*	.757**	1.000	-.334**	.524**	-.057
		Sig. (2-tailed)	.359	.580	.710	.792	.986	.073	.476	.122	.777	.012	.000		.001	.000	.584
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q44	Correlation Coefficient	-.163	-.054	.194	.152	-.010	-.069	-.012	-.146	-.024	-.249*	-.305**	-.334**	1.000	-.184	.296**
		Sig. (2-tailed)	.115	.604	.060	.142	.922	.504	.905	.159	.816	.015	.003	.001		.075	.004
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q45	Correlation Coefficient	-.069	-.186	.046	-.073	.011	-.113	-.056	.054	.062	-.037	.433**	.524**	-.184	1.000	.069
		Sig. (2-tailed)	.507	.072	.657	.484	.913	.276	.593	.605	.552	.721	.000	.000	.075		.507
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q46	Correlation Coefficient	-.184	-.067	.131	.044	.098	-.086	-.002	-.097	-.169	-.153	-.160	-.057	.296**	.069	1.000
		Sig. (2-tailed)	.074	.521	.205	.670	.347	.405	.983	.348	.101	.140	.122	.584	.004	.507	
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

TRB 2013 Satisfaction (bi-polar) related questions and overall satisfaction

			Q8	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q28	Q33	Q34	Q40	Q41	Q42	Q43
Spearman's rho	Q8	Correlation Coefficient	1.000	.058	-.109	.055	.043	-.012	-.105	-.067	.114	.018	.175	.012	.074	.131	.103	.126
		Sig (2-tailed)		.575	.293	.594	.677	.910	.311	.519	.269	.862	.090	.910	.475	.204	.323	.223
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q16	Correlation Coefficient	.058	1.000	.118	-.059	.121	.109	.203*	-.043	.191	.634**	-.162	.013	-.164	-.143	.185	.151
		Sig (2-tailed)	.575		.254	.572	.244	.295	.049	.682	.064	.000	.118	.897	.112	.166	.072	.144
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q17	Correlation Coefficient	-.109	.118	1.000	.176	.084	.116	.047	.116	-.095	-.043	.089	.064	.063	.185	-.069	-.066
		Sig (2-tailed)	.293	.254		.088	.418	.263	.648	.262	.361	.682	.392	.536	.542	.073	.506	.522
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q18	Correlation Coefficient	.055	-.059	.176	1.000	.364**	.287**	.387**	.235*	.055	.016	.752**	.355**	.119	.125	-.025	.022
		Sig (2-tailed)	.594	.572	.088		.000	.005	.000	.022	.599	.878	.000	.000	.250	.227	.811	.835
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q19	Correlation Coefficient	.043	.121	.084	.364**	1.000	.182	.322**	.020	.179	.164	.387**	.707**	.067	.039	.041	.190
		Sig (2-tailed)	.677	.244	.418	.000		.078	.001	.845	.082	.111	.000	.000	.518	.708	.694	.065
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q20	Correlation Coefficient	-.012	.109	.116	.287**	.182	1.000	.149	-.012	.165	.088	.297**	.304**	-.065	-.043	.090	.105
		Sig (2-tailed)	.910	.295	.263	.005	.078		.150	.906	.110	.395	.004	.003	.531	.681	.388	.310
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q21	Correlation Coefficient	-.105	.203*	.047	.387**	.322**	.149	1.000	.083	.215*	.196	.269**	.278**	-.092	-.014	.047	-.007
		Sig (2-tailed)	.311	.049	.648	.000	.001	.150		.426	.036	.057	.009	.006	.378	.889	.653	.947
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q22	Correlation Coefficient	-.067	-.043	.116	.235*	.020	-.012	.083	1.000	-.368**	-.064	.129	-.057	.531**	.331**	-.405**	-.102
		Sig (2-tailed)	.519	.682	.262	.022	.845	.906	.426		.000	.535	.211	.582	.000	.001	.000	.326
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q23	Correlation Coefficient	.114	.191	-.095	.055	.179	.165	.215*	-.368**	1.000	.222*	.096	.162	-.307**	-.130	.563**	.377**
		Sig (2-tailed)	.269	.064	.361	.599	.082	.110	.036	.000		.031	.353	.117	.002	.209	.000	.000
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q28	Correlation Coefficient	.018	.634**	-.043	.016	.164	.088	.196	-.064	.222*	1.000	.010	.003	-.048	-.192	.150	.186
		Sig (2-tailed)	.862	.000	.682	.878	.111	.395	.057	.535	.031		.920	.977	.645	.062	.146	.071
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q33	Correlation Coefficient	.175	-.162	.089	.752**	.387**	.297**	.269**	.129	.096	.010	1.000	.457**	.188	.088	.105	.110
		Sig (2-tailed)	.090	.118	.392	.000	.000	.004	.009	.211	.353	.920		.000	.068	.396	.311	.291
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Q34	Correlation Coefficient	.012	.013	.064	.355**	.707**	.304**	.278**	-.057	.162	.003	.457**	1.000	.062	.175	.060	.188
		Sig (2-tailed)	.910	.897	.536	.000	.000	.003	.006	.582	.117	.977	.000		.550	.089	.566	.069
		N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95

	Correlation Coefficient	074	-.164	063	119	067	-.065	-.092	531**	-.307**	-.048	188	062	1.000	665**	-.430**	126
Q40	Sig (2-tailed)	475	112	542	250	518	531	378	000	002	645	068	550		000	000	225
	N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Correlation Coefficient	131	-.143	185	125	039	-.043	-.014	331**	-.130	-.192	088	175	665**	1.000	-.332**	251*
Q41	Sig (2-tailed)	204	166	073	227	708	681	889	001	209	062	396	089	000		001	014
	N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Correlation Coefficient	103	185	-.069	-.025	041	090	047	-.405**	.563**	150	105	060	-.430**	-.332**	1.000	382**
Q42	Sig (2-tailed)	323	072	506	811	694	388	653	000	000	146	311	566	000	001		000
	N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
	Correlation Coefficient	126	151	-.066	022	190	105	-.007	-.102	377**	186	110	188	126	251*	382**	1.000
Q43	Sig (2-tailed)	223	144	522	835	065	310	947	326	000	071	291	069	225	014	000	
	N	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

TRB 2010 Quality related questions and overall satisfaction

			Q7a	Q7b	Q7c	Q8
Spearman's rho	Q7a	Correlation Coefficient	1.000	.037	.314*	.064
		Sig. (2-tailed)	.	.802	.034	.624
		N	61	48	46	61
	Q7b	Correlation Coefficient	.037	1.000	.664**	.750**
		Sig. (2-tailed)	.802	.	.000	.000
		N	48	76	56	76
	Q7c	Correlation Coefficient	.314*	.664**	1.000	.653**
		Sig. (2-tailed)	.034	.000	.	.000
		N	46	56	68	68
	Q8	Correlation Coefficient	.064	.750**	.653**	1.000
		Sig. (2-tailed)	.624	.000	.000	.
		N	61	76	68	95

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

TRB 2010 Security related factors and overall perception of security

			Q9	Q10a	Q10b	Q10c	Q10d	Q10e
Spearman's rho	Q9	Correlation Coefficient	1.000	-.083	.417**	.359**	.088	.153
		Sig. (2-tailed)	.	.423	.000	.000	.397	.140
		N	95	95	95	95	95	95
	Q10a	Correlation Coefficient	-.083	1.000	.253*	.246*	.416**	.258*
		Sig. (2-tailed)	.423	.	.013	.016	.000	.012
		N	95	95	95	95	95	95
	Q10b	Correlation Coefficient	.417**	.253*	1.000	.868**	.242*	.214*
		Sig. (2-tailed)	.000	.013	.	.000	.018	.037
		N	95	95	95	95	95	95
	Q10c	Correlation Coefficient	.359**	.246*	.868**	1.000	.254*	.283**
		Sig. (2-tailed)	.000	.016	.000	.	.013	.005
		N	95	95	95	95	95	95
	Q10d	Correlation Coefficient	.088	.416**	.242*	.254*	1.000	.560**
		Sig. (2-tailed)	.397	.000	.018	.013	.	.000
		N	95	95	95	95	95	95
	Q10e	Correlation Coefficient	.153	.258*	.214*	.283**	.560**	1.000
		Sig. (2-tailed)	.140	.012	.037	.005	.000	.
		N	95	95	95	95	95	95

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

TRB 2010 Satisfaction and Subscale clusters

			Q8	Q9	Light satisfaction	lightbipolar	accesssatis	airssatis	airbipolar	heatsatis	heatbipolar	noisebipolar
Spearman's rho	Q8	Correlation Coefficient	1.000	-.029	-.171	.097	-.027	-.072	-.026	-.095	.095	-.012
		Sig. (2-tailed)		.780	.098	.352	.795	.487	.799	.359	.361	.910
		N	95	95	95	95	95	95	95	95	95	95
	Q9	Correlation Coefficient	-.029	1.000	-.186	-.015	.318**	.187	.040	-.058	.039	.191
		Sig. (2-tailed)	.780		.070	.884	.002	.070	.703	.580	.708	.063
		N	95	95	95	95	95	95	95	95	95	95
	lightsatisfaction	Correlation Coefficient	-.171	-.186	1.000	-.141	.079	-.029	.139	.226*	-.063	-.114
		Sig. (2-tailed)	.098	.070	.	.174	.444	.778	.181	.028	.545	.273
		N	95	95	95	95	95	95	95	95	95	95
	lightbipolar	Correlation Coefficient	.097	-.015	-.141	1.000	-.079	.326**	.025	.376**	.291**	.002
		Sig. (2-tailed)	.352	.884	.174	.	.446	.001	.810	.000	.004	.987
		N	95	95	95	95	95	95	95	95	95	95
	accesssatis	Correlation Coefficient	-.027	.318**	.079	-.079	1.000	.228*	.183	.013	.000	-.004
		Sig. (2-tailed)	.795	.002	.444	.446	.	.026	.076	.899	.997	.972
		N	95	95	95	95	95	95	95	95	95	95
	airssatis	Correlation Coefficient	-.072	.187	-.029	.326**	.228*	1.000	.165	.441**	.148	.215*
		Sig. (2-tailed)	.487	.070	.778	.001	.026	.	.109	.000	.152	.036
		N	95	95	95	95	95	95	95	95	95	95
	airbipolar	Correlation Coefficient	-.026	.040	.139	.025	.183	.165	1.000	-.066	.076	.177
		Sig. (2-tailed)	.799	.703	.181	.810	.076	.109	.	.525	.466	.085
		N	95	95	95	95	95	95	95	95	95	95
	heatsatis	Correlation Coefficient	-.095	-.058	.226*	.376**	.013	.441**	-.066	1.000	.121	-.024
		Sig. (2-tailed)	.359	.580	.028	.000	.899	.000	.525	.	.242	.818
		N	95	95	95	95	95	95	95	95	95	95
	heatbipolar	Correlation Coefficient	.095	.039	-.063	.291**	.000	.148	.076	.121	1.000	.323**
		Sig. (2-tailed)	.361	.708	.545	.004	.997	.152	.466	.242	.	.001
		N	95	95	95	95	95	95	95	95	95	95
	noisebipolar	Correlation Coefficient	-.012	.191	-.114	.002	-.004	.215*	.177	-.024	.323**	1.000
		Sig. (2-tailed)	.910	.063	.273	.987	.972	.036	.085	.818	.001	.
		N	95	95	95	95	95	95	95	95	95	95

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

TRB 2013 Satisfaction Questions

			Q8	Q9	Q11	Q12	Q13	Q14	Q15	Q27	Q28	Q29	Q30	Q31	Q35	Q44	Q45	Q46
Spearman's rho	Q8	Correlation Coefficient	1.000	.612**	.055	.012	.497**	.046	-.052	.179	-.345*	.284	.091	.237	.303*	-.072	.145	.117
		Sig. (2-tailed)		.000	.725	.937	.001	.769	.740	.251	.024	.065	.563	.125	.048	.648	.355	.455
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q9	Correlation Coefficient	.612**	1.000	.146	.042	.466**	.099	.131	.256	-.186	.230	.238	.276	.255	-.197	.017	.063
		Sig. (2-tailed)	.000		.349	.788	.002	.528	.401	.098	.233	.138	.125	.073	.099	.205	.912	.687
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q11	Correlation Coefficient	.055	.146	1.000	.525**	.378*	.370*	.214	.065	.212	.218	.057	.178	.024	-.041	.123	-.039
		Sig. (2-tailed)	.725	.349		.000	.012	.015	.168	.681	.172	.161	.714	.253	.876	.794	.431	.803
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q12	Correlation Coefficient	.012	.042	.525**	1.000	.519**	.419**	.337*	.041	.200	.095	-.015	.015	.043	.193	.166	.181
		Sig. (2-tailed)	.937	.788	.000		.000	.005	.027	.793	.200	.543	.926	.925	.784	.214	.286	.245
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q13	Correlation Coefficient	.497**	.466**	.378*	.519**	1.000	.192	.305*	.233	-.133	.157	.165	.182	.068	-.110	.235	.083
		Sig. (2-tailed)	.001	.002	.012	.000		.218	.047	.133	.396	.314	.291	.243	.666	.483	.129	.597
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q14	Correlation Coefficient	.046	.099	.370*	.419**	.192	1.000	.290	-.042	.161	.110	-.005	-.179	.026	.215	-.077	.041
		Sig. (2-tailed)	.769	.528	.015	.005	.218		.059	.788	.302	.482	.977	.251	.868	.167	.622	.794
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q15	Correlation Coefficient	-.052	.131	.214	.337*	.305*	.290	1.000	.013	.090	.045	.050	.014	.022	-.002	.081	.129
		Sig. (2-tailed)	.740	.401	.168	.027	.047	.059		.933	.567	.776	.750	.929	.886	.988	.606	.411
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q27	Correlation Coefficient	.179	.256	.065	.041	.233	-.042	.013	1.000	-.193	.484**	.531**	.191	.245	-.100	.250	.059
		Sig. (2-tailed)	.251	.098	.681	.793	.133	.788	.933		.215	.001	.000	.220	.114	.523	.105	.705
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q28	Correlation Coefficient	-.345*	-.186	.212	.200	-.133	.161	.090	-.193	1.000	.205	-.197	-.188	-.358*	.219	-.385*	.082
		Sig. (2-tailed)	.024	.233	.172	.200	.396	.302	.567	.215		.186	.206	.226	.018	.158	.011	.603
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q29	Correlation Coefficient	.284	.230	.218	.095	.157	.110	.045	.484**	.205	1.000	.141	-.095	-.034	.203	-.091	.062
		Sig. (2-tailed)	.065	.138	.161	.543	.314	.482	.776	.001	.186		.367	.546	.826	.191	.562	.692
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q30	Correlation Coefficient	.091	.238	.057	-.015	.165	-.005	.050	.531**	-.197	.141	1.000	.310*	.059	-.190	.171	-.128
		Sig. (2-tailed)	.563	.125	.714	.926	.291	.977	.750	.000	.206	.367		.043	.709	.222	.272	.412
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q31	Correlation Coefficient	.237	.276	.178	.015	.182	-.179	.014	.191	-.188	-.095	.310*	1.000	.611**	-.282	.450**	.237
		Sig. (2-tailed)	.125	.073	.253	.925	.243	.251	.929	.220	.226	.546	.043		.000	.067	.002	.125
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q35	Correlation Coefficient	.303*	.255	.024	.043	.068	.026	.022	.245	-.358*	-.034	.059	.611**	1.000	-.128	.559**	.225
		Sig. (2-tailed)	.048	.099	.876	.784	.666	.868	.886	.114	.018	.826	.709	.000		.414	.000	.147

	N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Correlation Coefficient	-.072	-.197	-.041	.193	-.110	.215	-.002	-.100	.219	.203	-.190	-.282	-.128	1.000	-.072	.385*
Q44	Sig. (2-tailed)	.648	.205	.794	.214	.483	.167	.988	.523	.158	.191	.222	.067	.414	.	.647	.011
	N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Correlation Coefficient	.145	.017	.123	.166	.235	-.077	.081	.250	-.385*	-.091	.171	.450**	.559**	-.072	1.000	.044
Q45	Sig. (2-tailed)	.355	.912	.431	.286	.129	.622	.606	.105	.011	.562	.272	.002	.000	.647	.	.781
	N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Correlation Coefficient	.117	.063	-.039	.181	.083	.041	.129	.059	.082	.062	-.128	.237	.225	.385*	.044	1.000
Q46	Sig. (2-tailed)	.455	.687	.803	.245	.597	.794	.411	.705	.603	.692	.412	.125	.147	.011	.781	.
	N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

TRB 2013 Satisfaction (bi-polar) related questions and overall satisfaction

			Q8	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q28	Q33	Q34	Q40	Q41	Q42	Q43
Spearman's rho	Q8	Correlation Coefficient	1.000	-.006	.163	.036	.029	-.147	-.234	.170	.046	.345*	-.041	-.167	.125	.001	-.284	.315*
		Sig. (2-tailed)		.968	.296	.819	.854	.346	.131	.275	.771	.024	.796	.286	.424	.993	.065	.040
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q16	Correlation Coefficient	-.006	1.000	-.045	.187	.264	-.149	-.003	.310*	.237	.167	.018	.243	-.091	-.118	.029	.012
		Sig. (2-tailed)	.968		.774	.229	.087	.339	.983	.043	.126	.284	.911	.117	.562	.452	.854	.938
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q17	Correlation Coefficient	.163	-.045	1.000	-.021	-.292	.003	-.223	-.112	.180	-.079	.144	-.211	.044	.128	.102	-.012
		Sig. (2-tailed)	.296	.774		.893	.058	.984	.151	.473	.247	.613	.355	.174	.781	.413	.514	.939
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q18	Correlation Coefficient	.036	.187	-.021	1.000	-.127	.037	.163	-.118	.338*	.035	.584**	-.103	-.091	-.156	.167	-.001
		Sig. (2-tailed)	.819	.229	.893		.417	.814	.297	.452	.026	.824	.000	.510	.564	.318	.284	.996
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q19	Correlation Coefficient	.029	.264	-.292	-.127	1.000	-.117	-.055	-.209	.118	.106	-.173	.782**	.042	.093	-.063	.223
		Sig. (2-tailed)	.854	.087	.058	.417		.455	.726	.180	.453	.499	.267	.000	.790	.555	.690	.151
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q20	Correlation Coefficient	-.147	-.149	.003	.037	-.117	1.000	.071	.093	-.119	-.227	-.124	-.108	.261	.289	-.202	-.088
		Sig. (2-tailed)	.346	.339	.984	.814	.455		.653	.553	.446	.143	.426	.492	.091	.060	.195	.575
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q21	Correlation Coefficient	-.234	-.003	-.223	.163	-.055	.071	1.000	-.115	-.035	.214	.231	.165	.065	.129	.051	.208
		Sig. (2-tailed)	.131	.983	.151	.297	.726	.653		.463	.822	.167	.137	.289	.680	.408	.745	.181
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q22	Correlation Coefficient	.170	.310*	-.112	-.118	-.209	.093	-.115	1.000	.726**	-.109	-.228	.308*	.465**	.221	.340*	.359*
		Sig. (2-tailed)	.275	.043	.473	.452	.180	.553	.463		.000	.487	.142	.044	.002	.154	.026	.018
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q23	Correlation Coefficient	.046	.237	.180	.338*	.118	-.119	-.035	.726**	1.000	.105	.261	.101	.483**	-.066	.371*	.290
		Sig. (2-tailed)	.771	.126	.247	.026	.453	.446	.822	.000		.502	.091	.518	.001	.676	.014	.060
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q28	Correlation Coefficient	.345*	.167	-.079	.035	.106	-.227	.214	-.109	.105	1.000	.057	.126	.353*	-.066	.697**	.538**
		Sig. (2-tailed)	.024	.284	.613	.824	.499	.143	.167	.487	.502		.718	.422	.020	.676	.000	.000
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q33	Correlation Coefficient	-.041	.018	.144	.584**	-.173	-.124	.231	-.228	.261	.057	1.000	.099	-.151	-.195	.020	-.151
		Sig. (2-tailed)	.796	.911	.355	.000	.267	.426	.137	.142	.091	.718		.527	.333	.211	.899	.332
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Q34	Correlation Coefficient	-.167	.243	-.211	-.103	.782**	-.108	.165	.308*	.101	.126	.099	1.000	-.022	.201	-.085	.205
		Sig. (2-tailed)	.286	.117	.174	.510	.000	.492	.289	.044	.518	.422	.527		.887	.196	.589	.188
		N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43

	Correlation Coefficient	125	-.091	044	-.091	042	261	065	465**	.483**	.353*	-.151	-.022	1.000	483**	.582**	.321*
Q40	Sig (2-tailed)	424	562	781	564	790	091	680	.002	.001	020	333	887		001	000	.036
	N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Correlation Coefficient	001	-.118	128	-.156	093	289	129	.221	-.066	-.066	-.195	201	483**	1.000	-.221	.088
Q41	Sig (2-tailed)	993	452	413	318	555	060	408	154	.676	676	211	196	001		.155	573
	N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Correlation Coefficient	-.284	029	102	167	-.063	-.202	051	.340*	.371*	.697**	020	-.085	.582**	-.221	1.000	.669**
Q42	Sig (2-tailed)	065	854	514	284	690	195	745	.026	.014	.000	899	589	.000	.155		000
	N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Correlation Coefficient	.315*	012	-.012	-.001	223	-.088	208	.359*	290	.538**	-.151	205	.321*	.088	.669**	1.000
Q43	Sig (2-tailed)	040	938	939	996	151	575	181	.018	.060	.000	.332	188	.036	.573	.000	
	N	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

TRB 2013 Quality related questions and overall satisfaction

			Q7a	Q7b	Q7c	Q8
Spearman's rho	Q7a	Correlation Coefficient	1.000	.413*	.605**	.585**
		Sig (2-tailed)	.	.032	.001	.000
		N	36	27	25	36
	Q7b	Correlation Coefficient	.413*	1.000	.746**	.590**
		Sig (2-tailed)	.032	.	.000	.000
		N	27	34	20	34
	Q7c	Correlation Coefficient	.605**	.746**	1.000	.511**
		Sig (2-tailed)	.001	.000	.	.009
		N	25	20	25	25
	Q8	Correlation Coefficient	.585**	.590**	.511**	1.000
		Sig (2-tailed)	.000	.000	.009	.
		N	36	34	25	43

*. Correlation is significant at the 0 05 level (2-tailed).
**. Correlation is significant at the 0 01 level (2-tailed).

TRB 2013 Security related factors and overall perception of security

			Q9	Q10a	Q10b	Q10c	Q10d	Q10e
Spearman's rho	Q9	Correlation Coefficient	1.000	-.357*	.160	-.051	-.114	.042
		Sig (2-tailed)	.	.019	.306	.743	.465	.790
		N	43	43	43	43	43	43
	Q10a	Correlation Coefficient	-.357*	1.000	.378*	.249	.331*	.058
		Sig (2-tailed)	.019	.	.013	.107	.030	.712
		N	43	43	43	43	43	43
	Q10b	Correlation Coefficient	.160	.378*	1.000	.587**	.284	.198
		Sig. (2-tailed)	.306	.013	.	.000	.065	.203
		N	43	43	43	43	43	43
	Q10c	Correlation Coefficient	-.051	.249	.587**	1.000	.226	.173
		Sig (2-tailed)	.743	.107	.000	.	.145	.268
		N	43	43	43	43	43	43
	Q10d	Correlation Coefficient	-.114	.331*	.284	.226	1.000	.723**
		Sig (2-tailed)	.465	.030	.065	.145	.	.000
		N	43	43	43	43	43	43
	Q10e	Correlation Coefficient	.042	.058	.198	.173	.723**	1.000
		Sig. (2-tailed)	.790	.712	.203	.268	.000	.
		N	43	43	43	43	43	43

*. Correlation is significant at the 0 05 level (2-tailed).
**. Correlation is significant at the 0 01 level (2-tailed).

TRB 2013 Satisfaction and Subscale clusters

			Q8	lightsatisfaction	lightbipolar	airsatisfaction	acesssatisfaction	airbipolar	heatbipolar	noisebipolar
Spearman's rho	Q8	Correlation Coefficient	1.000	.060	-.059	.254	.235	-.061	-.127	-.147
		Sig. (2-tailed)		.701	.705	.101	.129	.698	.416	.346
		N	43	43	43	43	43	43	43	43
	lightsatisfaction	Correlation Coefficient	.060	1.000	-.004	.279	.192	.068	-.083	.237
		Sig. (2-tailed)	.701		.980	.070	.218	.664	.596	.125
		N	43	43	43	43	43	43	43	43
	lightbipolar	Correlation Coefficient	-.059	-.004	1.000	.264	.208	-.005	.064	.147
		Sig. (2-tailed)	.705	.980	.	.087	.181	.974	.683	.347
		N	43	43	43	43	43	43	43	43
	airsatisfaction	Correlation Coefficient	.254	.279	.264	1.000	.239	-.120	-.076	.237
		Sig. (2-tailed)	.101	.070	.087	.	.122	.442	.627	.125
		N	43	43	43	43	43	43	43	43
	acesssatisfaction	Correlation Coefficient	.235	.192	.208	.239	1.000	.030	-.268	.045
		Sig. (2-tailed)	.129	.218	.181	.122	.	.847	.083	.776
		N	43	43	43	43	43	43	43	43
	airbipolar	Correlation Coefficient	-.061	.068	-.005	-.120	.030	1.000	.088	-.205
		Sig. (2-tailed)	.698	.664	.974	.442	.847	.	.573	.187
		N	43	43	43	43	43	43	43	43
	heatbipolar	Correlation Coefficient	-.127	-.083	.064	-.076	-.268	.088	1.000	.054
		Sig. (2-tailed)	.416	.596	.683	.627	.083	.573	.	.730
		N	43	43	43	43	43	43	43	43
	noisebipolar	Correlation Coefficient	-.147	.237	.147	.237	.045	-.205	.054	1.000
		Sig. (2-tailed)	.346	.125	.347	.125	.776	.187	.730	.
		N	43	43	43	43	43	43	43	43