A NOVEL METHODOLOGY FOR E-LEARNING SPACE DESIGN IN HEI CAMPUSES

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PhD
2011

A NOVEL METHODOLOGY FOR E-LEARNING SPACE DESIGN IN HEI CAMPUSES

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BSc. Arch, MSc. Arch, MSc. CPM

A thesis submitted in partial fulfillment of the
Requirements of the University of Wolverhampton
For the degree of Doctor of Philosophy

School of Technology (STECH)
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July 2011

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ABSTRACT

The Higher Education Institution and the Construction Industry are yet to define the most appropriate and effective design parameters for E-learning spaces. Those which exist, focus mainly on cost, budget and timely delivery i.e. the process only not the product. An effective approach to E-learning space design is needed to address the problems of space efficiency, effectiveness, quality, innovativeness, performance and client satisfaction.

This study aimed to develop a novel methodology for e-learning space design, by investigating: the impact of e-learning on facilities and design; the impact of e-learning on the design of future spaces; the impact of blended learning on space design; designing for the learn anytime, anywhere paradigm; security issues of e-learning and e-learning space design, the levels of design risk in an e-learning infrastructure and inclusive design issues. A Grounded theory approach was used during initial desk studies, synchronized with a three part forum and pilot survey of 33participants. From this process, two hypotheses emerged; firstly, e-learning space design could affect users' learning outcomes and secondly that; user's learning requirements were different and varied. To investigate further, site based analyses of 11 HEI's, 10 interviews and subsequently a questionnaire survey was administered. Users' and stakeholders requirements and good examples of e-learning space design were identified. Data were analysed using a mixed-method research design approach.

Three main constructs, **Space design, Technology** and **the E-learning Space Design research focus** (ELSD focus)**,** emerged as significant components in the development of a novel framework for the design of e-learning spaces. The relationship between the components is such that the design of spaces with consideration of the ELSD research focus would ensure the effective identification, interpretation and delivery of users' requirement while maximising the benefits of the adoption of appropriate technology within HEI facilities. This was therefore proposed as the realistic framework/model for future design of E- learning Spaces in HEI campuses. The framework was adapted into a conceptual design guide to provide guidance for future space design. It is expected the study will support the HEI sector globally as it moves towards achieving best practice solutions to future E-learning space design in HEI campuses.

ACKNOWLEDGEMENT

First and foremost, my deepest gratitude is to God, the custodian of all knowledge and wisdom, for the opportunity and privilege given to me to undertake this research work at the University of Wolverhampton

I am very grateful to my Director of Studies; Prof. Sabah Mushatat- a very hard working and focused academic, who's genuine interest, commitment, constant support, knowledge and guidance resulted in the successful completion of my programme. At the same time I must appreciate Prof Paul Olomolaiye my previous Director of Studies who's intelligence, drive and dedication laid the foundation for the commencement, progress and outcome of the work despite his academic commitment as the then Dean of School until his subsequent transfer to University of West of England.

I am also grateful to my supervisors, Dr David Heesom for his follow up and support and Angela Nash for her patience and assistance with the data gathering stages of the forums and case studies.

I thank all the academics, HEIs and industry partners for taking time to participate in the forums, interviews, case studies and questionnaire surveys in particular Prof. Roy Newton, Helen Gale of ILE, Dr Ahmed Ankit of Ajman University UAE, Dr Akin Oluwatudinmu, Les Watson and Leonie Weiss of AMA.

I also thank staff of former School of Engineering and the Built Environment now School of Technology for the support at different stages of my programme.

My sincere gratitude goes to my family; to my parents, Mr and Mrs S.A. Adejumo and Parents In-law, Mr and Mrs Z.K. Dare for their constant prayers and love; to my husband Oluwatoyin O. Dare, for the patience and understanding, and to my dearest children Oluwatobi (son) and Oluwatomisin (daughter) for being there for me, through it all… we did it!

I also thank all my sisters, for their encouragement, prayers and goodwill.

I am indebted to my mentor Dr David Oloke and his family for the genuine love and encouragement, to me and my family. Thank you so much God Bless You all

I also thank Dr and Mrs Mohammed and family for their support
To my friends Dorothy Nmadu, Osebi Mosugu, Adeola Adeyemi, Dr Folayele Olabisi, Dise Apulu, and Buki Boluro-Ajayi for your love and prayers, I say thank you
I thank my co- researchers Dr Adam Feng, Amal Oraifige, Jonathan Ota, and others who made this journey memorable and exiting.

Finally I am grateful to the Senior Pastor and members of Oasis of Love International Centre, God bless you all.

DEDICATION

To my Parents, Mr and Mrs S. A. Adejumo, TOYIN, TOBI and TOMISIN DARE

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GLOSSERY OF TERMS/ABREVIATIONS

AMA- Alexi Marmot Associates

AUDE-Association of University Directors of Estates

CD-ROM-Compact Disc- Read Only Memory

CELT- Centre for Education Learning and Teaching

CISCO- Cisco Systems

CUD- Centre for Universal Design

DfES-Department or Education and Skills

ELSD-E-learning Space Design

ELSD Research Focus- The third construct for frame work developed comprising of the seven focus points outlined and investigated.

HEA-Higher Education Academy

HEDQF- Higher Education Design Quality Forum

HEFCE- Higher Education Funding Council of England

HEI- Higher Education Institutions

JISC-Joint Information Systems Committee

LGMF- Leadership Governance and Management Fund

OFSTED- Office for Standards in Education

OED- Oxford English Dictionary

PDA-Personal digital Assistant

RFID-Radio Frequency Identification

RIBA- Royal Institute of British Architects

SEDA- Staff and Educational Development Association

SMG-Space Management Group

TSL-Technology Supported Learning

UCISA- Universities and Colleges Information Systems Association

UNESCO- United Nations Educational Scientific and Cultural Organisation

VLE- Virtual Learning Environment

WBDG- Whole Building Design Guide Sustainable Committee.

CHAPTER ONE: INTRODUCTION AND GENERAL OVERVIEW

Section One presents an introduction and critical analysis based on reviews of the general subject area from Chapter one and ends in Chapter five.

Chapter one is an introduction to the research scope; it presents a general background and rationale behind the research. An overview of the research into e-learning space design on HEI campuses, with an explanation of how the research focus emerged is clearly presented. The development of research aim and objectives of the study, along with the research questions, hypothesis, benefits and hindrances to achievement of research goals were discussed. The research methodology developed as well as the philosophical context of research was clearly defined. Chapter one concludes with a thesis structure outlining briefly what each subsequent chapter contains.

1.0 GENERAL BACKGROUND THINKING OF THE STUDY

Further to the successful bid to the Higher Education Funding Council of England (HEFCE) by the University of Wolverhampton, funding to undertake research into the area of enhancing the design of spaces to support e-learning as part of the HEFCE Strategy, 2005 was secured (See Appendix A). This research work complemented an earlier research interest, which the researcher had investigated on the design quality of the teaching and learning spaces / environments within Higher Education Institution (HEI) campuses, considering the recent technology advances and development in the mode of delivery of learning. The thought of how these may affect the future design of technology supported learning spaces and the users' of e-learning spaces was of interest and led to the desire to investigate further.

While thinking about the possibility of carrying out further and meaningful research in this area, initial desk studies was carried out in order to identify a research direction. The HEFCE project had outlined some areas of interest to be investigated; mainly that of examining how HEI can design spaces and buildings to provide a more effective e-learning experience in addition to examining how teaching and learning can be enhanced via e-learning. After careful consideration of the set task, it became obvious that there were several research approaches that could be taken; such as a user-led approach to e-learning space design based on factors such as user learning patterns and user requirements; another research approach considered was the level of stakeholders ‘expectation and involvement as the financiers/initiators of building construction projects in HEIs and controlling factors such as the available funding, planning, time constraints were thought to be aspects worth investigating; also another approach that was a possible direction was a critical analysis in which critical reviews of recent cutting edge technology for e-learning delivery, and their impact on design of teaching and learning spaces in HEI building construction would be studied such as the recent virtual online teaching technology (VLE). All of these were considered along with a pedagogical approach based on hypothesis and the possibility of applying philosophical contexts to the research. These different approaches were all seen as important aspects related to the effective delivery of the design of a technology supported learning environment. These initial considerations helped to identify the broader but important issues related to design such as, security, risk, planning, funding/budget, users’ requirement etc., as some of the variables that may affect space design in this context. Also a suitable research scope which could produce valuable amount of data was defined and later refined.

At the initial stage of desk studies, focus groups were organised simultaneously and held in a three part session. The essence of this process was to obtain useful background understanding of current thinking and ideas surrounding the subject area. These served as the background to the research direction that evolved.

The initial studies led to the thinking that a critical review of the evolution of the learning space was a fundamental starting point. Thus a significant amount of desk studies and literature reviews forms part of this study as it was thought that the research needed an approach that would eliminate pre-conclusions and bias in order to put forward original, new, and novel results. About 15 HEIs were initially contacted for investigations about what existed in their buildings and what was being done if any with regards to the e-learning space design in the future.

This research endeavour has been placed within the intellectual context of a philosophical approach that combines inductive and grounded theory methods. “Induction is a process of reasoning, whereby, observations are made, and then used to build general statements and hypothesis that may be tested” (John Locke and Francis Bacon in Kelle, 2004; 2005). This is not the same as the "general method of comparative analysis" of Glassier and Strauss (1967) Grounded Theory; that would enable the "emergence" of categories from the data such that “in Grounded Theory, data are systematically gathered and analysed, and then used to generate a theory” (Glassier and Strauss (1967); Cohen and Crabtree (2006)but induction is an alternative to the hypothetical-deductive approach in social research (Kelle, 2004; 2005).This marriage of both was thought to be the most appropriate method involving qualitative and quantitative analysis as well as descriptive data from the site based analysis in order to present a holistic and detailed work (Yin, 1994, 2009)

As noted by Watson (2006), space design is about the people, it is about the environment; therefore a comprehensive study of these two dynamics became the underlying ethos that defined this research endeavour as it was thought that these two valuable components would be the purpose for which a research of this nature ought to be done. The assumption being that the outcome will benefit firstly the people (i.e. users’) as well as the physical environment (e-learning focused buildings or spaces) as it were.

An output for the research was initially a subject of concern, therefore an idea of developing a guide on how to design effective e-learning spaces within HEIs based on the parameters investigated was considered a likely research outcome. This then led to the thinking that a novel methodology for e-learning space design in HEI campuses could be an appropriate title for this study; as it presented an overarching description of the endeavour being undertaken.

It is expected that this work will go a long way to assist those HEIs who wish to embark on space design projects in future (new builds and existing renovations) as well as the Construction Industry.

1.1 INTRODUCTION TO THESIS

This research examined not the delivery of learning and teaching via e-learning, but how HEI’s can design good buildings and learning spaces on campus, and manage the infrastructure to provide effective e-learning experience for users. Furthermore, the main focus of the research was the development of a new framework that can provide guidance on ‘Good design and flexible use of e-learning environments on HEI campuses; unlike the HEFCE’s flexibility for learning strategy which focused on the flexibility of the mode of delivering taught courses.

The Government's White Paper 'The Future of Higher Education' (DfES, 2003) referred to 'more flexibility in courses, to meet the needs of a more diverse student body', and put forward the idea of two-year compressed degrees as a means of furthering flexibility in learning. They allocated £3 million from a Strategic Development Fund (SDF) to support the general development of flexible learning with the aim of concentrating on flexibility in terms of variation in pace and intensity of study; combined with flexibility in method of delivery.

Thus the essence of this study was to carry out detailed investigation into the design of technology supported learning spaces (TSL) within HEIs. In order to achieve this objective, this research involved a critical analysis of e-learning space design with particular interest in the following key areas which were termed the e-learning space design (ELSD) research focus.

a. The impact of e-learning on facilities and design
b. The design of future spaces and how we get there
c. The impact of blended learning on the design of spaces
d. Designing for the learn anytime, anywhere paradigm
e. The security issues of e-learning and e-learning space design, and
f. The levels of design risk in an e-learning infrastructure and also
g. inclusive design and its future direction

The review of literature in line with the above provided significant information for definition of a general/ broad overview of the research scope and facilitated the acquiring of data necessary in order to have a deeper understanding of the specific issues of user requirements, existing design situations and design problems. Investigation of selected case studies, enabled the researcher identify industry progress and directions in this regard.

From literature reviewed, it was stated that efficiently designed e-learning environments and spaces are required to improve the delivery of Technology Supported Learning (Newton, 2006), thus it can be argued that the development of a model for achieving efficiently designed e-learning environments will 'benefit the Higher Education (HE) sector significantly' as it will enable the identification of good practice examples in the design of buildings and spaces on campuses, while providing a bench mark for the management of such infrastructure in future.(Newton, 2006)

Winston Churchill stated that ‘we shape our buildings and afterwards our buildings shape us’ Jamieson, Fisher, Gilding, Taylor, and Trevitt (2000), and Watson (2006),agrees with the above school of thought. This therefore lends credence to the importance of this research, as it implies that efficiently designed spaces within technology focused buildings can ultimately impact on the effective learning output of its users. This was also echoed by Newton (2005).Harrison and Dugdale’s (2004) opinion that what is required is ‘a fundamental re-evaluation of the way that academic institutions function’ as they supposed that changes in space utilization had been ‘challenging traditional academic practice’ invalidates this line of thought, as it suggests that space design concerns should be the foundation on which the goals for designing an e-learning space are determined instead.

To help the reader understand the meaning of some terms used in this study, a brief description and explanation is provided in the Glossary of terms however some key phrases are discussed hereunder.

1.1.1 Definitions:

I. E-Learning: It is defined as the use of Information Communication Technology (ICT) as a communications and delivery tool between individuals and groups to support students and improve the management of learning; this encompasses flexible learning as well as distance learning (HEFCE, 2006).

E-Learning can simply be defined as technology supported learning (Smith, 2006; Alshawi, Goulding and Faraj, 2006).

II. Technology Supported Learning (TSL)

Newton (2005) observed that TSL augments the distinctive mode of learning offered to a certain extent and does not replace it. His report reiterated that A technology supported learning environment supports current learning modes, giving way to progressive levels of learning skills, enables the management of constructive learning and provides electronic access to learning and evaluation materials thereby creating the opportunity for the anytime anywhere learning scenario.

III. Space Design: In this context refers to the physical layout and plan of learning spaces or environment within an HEI.

VI. Users: Refers to the customers for which the spaces are designed; students, staff and visitors.

VII. E-Learning vs. E-Learning space design:

In order to define 'e-learning space design', the term E-learning has to be understood. E-learning involved anything from watching a video, loading a tutorial from a CD-ROM, to enrolling in a virtual classroom (Harasim, 1990; Harris, 1994). It was also noted that the goal of any learning environment was to create a community of learners (Davie and Wells, 1991; Harasim, Hiltz, Teles and Turoff, 1995). E-learning they argued can support the needs of universities, academics and publishers,(McCormack and Jones, 1997) by increasing the reach of the learning environment to include those separated by time and space; (Alshawi, Goulding and Faraj, 2006).

Research into the impact of learning environments on students showed three main areas of influence: it motivated their work, facilitated inspiration amongst students and provided support facilities relevant to the course content (CABE, 2005). Therefore, an e-learning space should enable persistent interaction among learners, trainers, operators, and educators so that it enhances acquisition of the knowledge requirement of diverse learners as well in specific and varied environments. (http://www.quantumleap.us/Research&Development/PublishedPapers, 2006).

The space design should increase learning flexibility; provided virtual work spaces; Informal learning, creating fun and interesting dynamics between students. The proper design and management of these areas should promote interactive and collaborative learning. (www.http:/incsub.org/soulsoup, a case study from IDEO web site, 2006).

Smith (2006), defined an e-learning space as a space that is technologically supported for learning, designed to provide simultaneous support for face to face (f2f) and virtual learning and allows for innovative experiential learning. This reiterates what had been stated by JISC (2005, 2008) concerning the requirement for rich learning spaces to reflect an institution's image, ideas and policy on education. (Watson, 2006)

As stated by master designer Vitruvius, **"in essence the design and architecture of learning environments** (including TSL) **should** exhibit the three qualities of ***firmitas, utilitas*** *and* ***venustas*** i.e. it must be solid (durable), useful (functional) and beautiful (aesthetically pleasing)"(Vitruvius, Pollio; transl. Morgan, 1960)

1.2 SPACE TYPES WITHIN AN EDUCATION INSTITUTION

Learning spaces were categorized by Smith, (2006) as general teaching spaces, vocational spaces, learning centres and social spaces. However, seven space types were identified, by Alexi Marmot Associates (AMA) (2006a).See fig 1.1-1.7 these are:-

1 Group teaching/learning space

2 Simulated/special learning environments

3 Immersive environments

4 Peer-to-peer and social learning

5 Learning cluster

6 Individual spaces

7 External spaces

1. Group Teaching/Learning Space

Watson, Anderson and Strachan –Davis (2007) defined a Group teaching/ learning space as a space that allows the learners to participate in a collaborative teaching and learning activity that enables them to share, store and retrieve knowledge in a productive way that will enhance the overall performance of the group. See fig 1.1

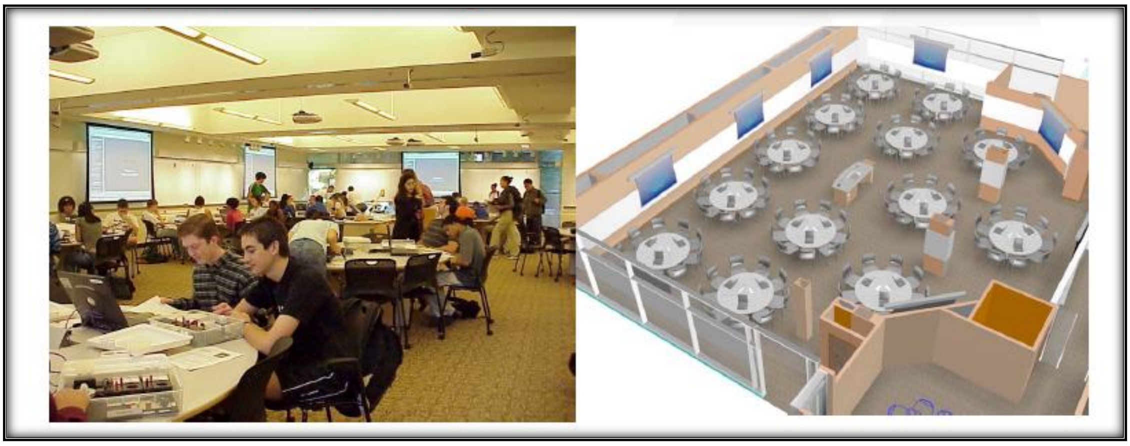


Figure 1.1 MIT TEAL (Technology Enabled Active Learning) project for teaching physics and engineering.

Source: AMA (2006a) Image: Prof John Belcher

2. Simulated/Specialised Learning Environments

Figure. 1.2 Specialised Learning Spaces

Source: AMA (2006a)

3. Immersive Environments

Figure 1.3 Customised Learning Spaces, Stanford University Centre for Innovations in Learning.

Source: AMA (2006a)

4. Peer-to-peer and Social Learning

Figure 1.4i South East Essex College dinning decks: Figure 1.4ii University of Wolverhampton Social Learning space

Source: AMA (2006a)

5. Learning Cluster

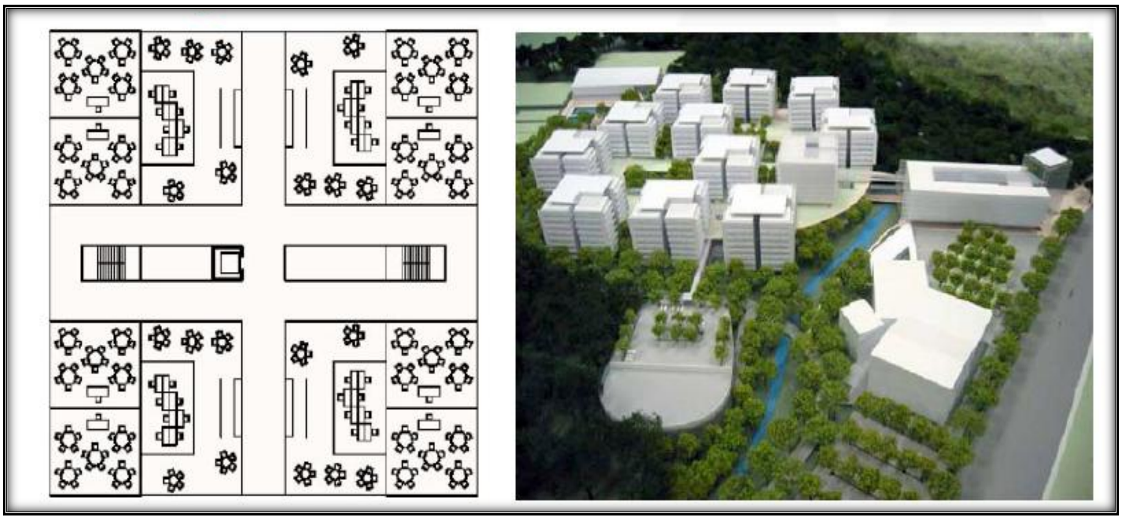


Figure 1.5 Singapore Polytechnic from Kenn Fisher
Source: AMA (2006a)

6. Individual Spaces

Figure 1.6 Student Accommodations
Source: AMA (2006a): Photo Rowan Huppert

7. External Spaces

Figure. 1.7 MIT Stata Centre Amphithéâtres

Source: AMA (2006a) Photos: Rowan Huppert

External spaces refers to spaces designated for teaching and learning situated outside a building or educational facility. This could be a courtyard area or purpose built space on the campus. Research shows that the use of external spaces for teaching and learning activities results in:-increased learning flexibility; provides virtual work spaces; Informal, outdoor classrooms provide ideal grounds for learning, creating fun and interesting dynamics between students. The high visibility of these areas promotes interactive and collaborative learning (CL) (no date) www.http:/incsub.org/soulsoup, a case study from IDEO web site)

1.3 RESEARCH AIM

The aim of this research is to develop a novel methodology/framework that will provide guidance for the design of future e-learning spaces and facilities particularly in HEI campuses.

1.3.1 The E-learning Space Design Research Focus

In order to develop the research aim, a review of the broader areas termed the ELSD research focus was done as presented hereunder.

I. The Impact of E-Learning on Facilities and Design

The first fairly understandable impact identified was that e-learning, sometimes take place instantaneously i.e. in ‘real-time’, therefore suitable network infrastructures were needed to be designed and incorporated into the facility (HEFCE, 2005). It was also asserted that alongside this was the rather vague characteristic of ‘design responsibility’ for the constituent parts of the infrastructure and how these were to be incorporated generally into the design. Findings indicate that there were a number of cases of good practice, but a lot more of the bad cases. But if the design was suitable, it could sustain other benefits, for example the ‘integrated business and learning processes’ and ‘intelligent’ buildings (HEFCE, 2005; Clements-Croome (ed.) 2009; Pg. 3)

II. The Design of Future Spaces

Buildings should feel good (Clements-Croome, 2009). The editorial explained that ‘changes in society and technology’ were shaping our future with respect to demographic changes globalization and communications. It was stated that though these changes were important, another very important fact was that there was a substantial body of evidence that had begun to emerge, which indicated that ‘physical and spatial environments’ could impact on ‘people’s mood and work performance and hence work output’.

For many years the archetypal view of e-learning had been “serried ranks of computers in rooms” (Newton and Nash, 2006). It was assumed that ‘this was for good reason with regard to physical and I.T-based architectures and also software management capabilities’ (HEFCE, 2005).‘However, with the advance of technology it is now possible to be more “adventurous” with e-learning spaces’. (HEFCE Strategy 2005; Watson, 2007) such that ways of encouraging group working, access for disability, software separation of computer “universes” and the use of supporting audio visual aids (AVA), all affect the design’. As shown in figure1.8

Figure1.8 Huddersfield University, Teaching room
Source; AMA (2006b) Workware (Tim Hodges Photography)

An example where the e-learning space design is adventurous, supporting group working as well as flexible learning needs. AMA (2006b) stated that ‘within further and higher education, there were significant changes in ways of working, teaching and learning partly driven by the availability and use of new technologies’. Clements-Croome (2009) noted that in the future, value for money; the ability to deal with sustainable issues (energy, water, waste and pollution); and the ability to deal with technological and sociological changes, will be vital factors for the development of intelligent buildings.

III. The Impact of Blended Learning on the Design of Spaces

‘Blended learning’ meant that increasingly individuals studying within the same environment regardless of its nature (formal or informal space) may actually be occupied in various sorts of activities (Gale and William, 2007; HEFCE, 2005). This increasing study pattern therefore flagged up the question of how the best spaces and infrastructure to support this requirement could be designed. It was also noted that another concern this flagged up was how this was to be integrated into the overall design of the learning campus. Figure 1.9 below is an example of a blended learning environment. The picture shows a learning space that combines studying with other types of social activities.

Figure 1.9 University of Wolverhampton Café
Source: (Gale, 2007)

IV. Designing for the 'Learn Anytime, Anywhere' Paradigm

The HEFCE Strategy document (2005) asserted that currently as 'learning media' comes from a lot of diverse sources, 'students were able to move to a 'learn anytime, anywhere' paradigm'. It noted that on campus this approach had an important consequence on the type of the learning spaces that was required. It stated that it was presently a requirement to provide for the variety of personal learning methods in the same facility or place, in that way some students will not be compelled into learning patterns that perhaps may not be suitable for them. The HEFCE strategy document (2005) enquired that could it be that the flexibility in learning methods and the motivation for the 'learn anywhere, anytime' scenario could be facilitated by the design of learning spaces across campus.

V. The Security Issues of E-Learning and E-Learning Space Design

Reviews show that security issues could be presented in different forms (Newton and Nash, 2006). Firstly, the physical security of the space and the facilities within the space was an aspect, while the security of the information and data being accessed and created was a second and thirdly, the security of corporate information and data (Director of Estates, University of Essex 2007). The physical security issues could be due to the 'openness of spaces and the avoidance of design traps such as "nooks and crannies" and also the physical security features that could be constructed into the e-learning facilities themselves (Nash and Newton, 2006; HEFCE, 2005).

Information and data security issues were arguably not as crucial as they were in sectors such as the banking sector; however, there was still good design practice such that security risks in this area could be reduced.

VI. The Levels of Design Risk in an e-Learning Infrastructure

'There are a number of facets to design risk with regard to e-learning environments' (Director of Estates, University of Essex, 2007; HEFCE Strategy document, 2005). For instance, the learners themselves might be uncomfortable with the spaces that are made available or the staff may discover that they are hindered from delivering the necessary learning; therefore the question arising from this as noted was that of how best to reduce the risk of such unforeseeable eventualities? It was further asserted that the persistent advancement of technology also brought with it additional design risks. Research suggests that it was imperative that designs were sufficiently adaptable and flexible enough to accommodate the 'long-term sustainability of facilities in the light of technological change (Clements-Croome, 2009; Watson, 2006; HEFCE, 2005) which HEFCE (2005) suggested 'could result in expensive obsolescence'. The assumption being that flexibility more often than not was expensive; therefore the question this flagged up was, to what degree could 'long-term sustainability really be achieved'(HEFCE, 2005).

VII. Inclusive Design and Its Future Direction

DfEE (2001) states that inclusive design attempts to break down needless obstacles and prohibitions and in so doing it most often results in unexpected and better-quality design solutions which would be beneficial to all. Ii was noted that the national curriculum had set out three main goals for inclusive learning traditions and that these goals were evident and enhanced by some principles which relates to the design of new builds, or alterations done to existing facilities.

The principles of inclusive design stated were that, firstly learners with special educational needs be treated with dignity and respect together with other school members and that their needs be adequately catered for within the learning environment. The second principle highlighted was that the school was to provide a welcoming, suitable and safe environment for the needs of all learners including those with special learning needs and disabilities and thirdly that the educational buildings and surroundings be designed to support all users of the educational facility in gaining access into and around it such that they can take part in every aspect of the learning process to the best of their ability and interest. The Bulletin asserted that becoming more inclusive was a process and not an event and in the light of the speed of technological uptake for teaching and learning, then there was a question of how to incorporate and maintain inclusive design solutions in e-learning focused buildings and learning spaces of the future.

The ‘process of design was also changing’ with respect to ‘the co-operative involvement of services to provide comprehensive e-learning spaces’ (DfEE, 2001) therefore the issues of the design process the shift towards inclusive design in order to deliver appropriate spaces is important. An example is the Eden project, Cornwall as shown in figure 1.10

Figure 1.10 The Eden project

Source: (http://www.sensorytrust.org.uk/projects/eden/core.html) accessed online 17May 2010

1.4 THE RESEARCH HYPOTHESIS AND QUESTIONS

From the foregoing, two hypotheses and seven questions emerged.

Hypothesis No 1- A user’s learning experience can be improved by the provision of a good e-learning environment.

Hypothesis No 2- User’s learning requirements are different and varied as such they are an important criteria for consideration in e- learning space design.

The assumption being that good design of technology supported learning spaces has an impact on the users' learning outcomes.

1.4.1 The Research Questions

The questions that evolved from an analysis of the key issues investigated were as follows:-

I. How has technology advancement affected the design or provision of e-learning environments and facilities in HEIs?

II. How can user requirement and input affect the design of e-learning environments (flexibility, multifunction of spaces and material use)?

III. How will blended learning affect the future design of social, teaching and vocational learning environment?

IV. How can space design promote security of facilities in an e-learning environment?

V. How can levels of design risk in an e-learning infrastructure be reduced? And in addition to the above,

VI. How can inclusive design be incorporated in future e-learning spaces?

The attempt to find answers to the above questions eventually enabled the research aim and direction to be further developed and underpinned. Below is a brief discussion on the findings in this regard.

The expectation was that in asking the above questions, the guideline for defining the scope of the study could then be put in place so as to prevent the research from losing its main focus. Furthermore, 'an important factor in the design of any physical environment was the issue of sustainability' (Clements-Croome, 2009) and that as the issues of sustainability in design have grown to become major determinants for the successful delivery of design projects; the research was critically concerned with "environment" even though in this context it was about the e-learning environment, (Watson, 2007).

It was considered that the questions asked would go a long way to guide the research work and enable findings meet requirement for the design of any TSL facility with respect to sustainability in design.

1.5 RESEARCH OBJECTIVES

The research objectives have been developed to enable the achievement of the overall aim that was outlined above. In identifying the research objectives, the key aspects which the research sought to address were incorporated as well because they helped to define the research scope and they also enabled an understanding of what was the realistic and practical outcome expected at the conclusion of the study. It can thus be assumed that the next logical step would be to examine how to go about achieving the set task and so the proceeding section below looks at the step by step process that was used as well as the supporting background knowledge or the rationale behind the objectives.

1.5.1 Research Objective One: - To identify basic elements for good design in e-learning space design

The first objective was achieved by carrying out detailed desk studies on the general subject area from literature reviews of reports, conference materials, books, JISC website and e-journals on the design of good e-learning environments in HEIs. In order to identify past trends and areas of similar research endeavour if any that would give the research a depth and background that was factual, realistic and convincing.

Furthermore, a three - part forum was successfully hosted as a source of current information for the desk studies. Case studies, of e-learning environments in selected Institutions were also conducted involving site based analysis of users' within such spaces; in order to obtain current, practical as well as a theoretical background to the subject area. The findings from the mixed method research approach adopted are discussed in the chapters on data analysis.

From literature reviewed, JISC (2006) designing 21st century learning report described educational buildings as an "expensive long term resource" where space design was needed to exhibit some key attributes. The elements of good e-learning space design identified by JISC (2006) were; **flexibility**- in order "to accommodate both current and evolving pedagogies"; **future – proofed**- in order "to enable space to be re- allocated and re-configured"; **boldness**- in order "to look beyond tried and tested technologies and pedagogies"; **creative**- in order "to energise and inspire learners and tutors", **supportive-** in order "to develop the potential of all learners" and **enterprising**- in order "to make each space capable of supporting different purposes.", A view also expressed by Watson (2006).

1.5.2 Research Objective Two: -To identify essential user learning patterns that affect e-learning space design as well as stakeholders' involvement.

To achieve this objective, a structured questionnaire survey was administered in order to identify the key design requirements from users' and the stakeholders involved in the design, finance and delivery of e-learning spaces. The survey was launched online in the first year of the research; the process and outcome were discussed in the methodology and fieldwork. Other Post occupancy surveys obtained from HEIs visited and general surveys such as the National Student Survey 2006/2007-2009 were also reviewed along with related publications in this regard. Below is a summary of what was reviewed.

From current sources of literature and publications, some of the essential user learning patterns identified were said to be based on the users' expectations and requirements (JISC, 2006; Lou, E.C.W. and Alshawi, M. (2009). According to JISC, (2006) eSpaces Report, which presented findings from a qualitative study involving the use of telephone interviews with key agencies and four case studies, desk research and literature combined with quantitative online survey of learning and teaching trends in Scottish tertiary education, the emerging trend with respect to user requirement was that there was a **demand for 'personalised and flexible learning provision'**. While the learner need and expectations which were identified by JISC (2006) 'Designing spaces for effective learning Report' (which carried out the study using a mixed method approach combining qualitative data gathering methods in form of case studies of eleven refurbishments or new builds within UK institutions with quantitative data obtained through JISC eSpaces survey) as drivers for change, with respect to the user expectations and requirements which were-: i) **the need for motivational**, ii) **creative**, iii) **technology-rich learning spaces** that would **support collaborative, personalised as well as blended models of learning.**

The SFC Spaces for Learning (SFC, 2006) Report identified the **diversity of student populations** as a driver for change that would affect the design of the learning space as they would have diverse learning requirements. The report suggested that there was a need for a **diverse range of learning styles** and approaches to meet this need. The results the SFC (2006) report presented were obtained from both qualitative and quantitative data.

The Space Management Group report (SMG, 2006) 'Impact of future changes in education' which presented findings from a literature reviewed and qualitative data from -semi structured interviews and visits to a sample of seven HE institutions (in order to find out about 'potential decreased change within existing envelope increase in space use') stated that learners had social expectations which led to an increased **demand for 'student –centric learning spaces** which were also based on the students' choice of courses. Furthermore the JISC (2006) Report stated that the pedagogic requirement suggested a shift towards active, learner (user) centred approaches which were based upon the use of digital technologies such as mobile and wireless learning styles.

JISC (2006) Report highlighted another user requirement, the **need for inclusivity** as a driver for change 'that is the ability of an institution to meet the requirement for a **widened access' and participation of learners (users)**. In addition to these there was also the need for efficiency as the report noted, and the demand for an **increase in space utilization**; **spaces that were multipurpose** to adapt to and accommodate increase or decrease in student numbers, spaces that would be **centralised and accessible** on a booking and timetable scheduling system that was also **flexible and innovative.**

1.5.3 Research Objective Three: - To develop a set of guidelines for good practice in e-learning space design

This objective was achieved through the critical analysis of data and the identification of good practice examples and the underlying factors that could then be used as guidelines for achieving best practice designs in future.

According to Clements-Croome, Mumovich, MacMillan and Samad (CIB, 2010) Buildings could enhance teaching and learning by high quality design and management, and 'the physical environment affects not only the body but the mind in terms of concentration'. Clements-Croome et-al (2010) claimed that it was unfortunate that the environment in many schools was considered to be exasperating by the pupils and teachers. Their paper focussed on the design and management processes and recommended a number of actions which they claimed could increase the possibilities of achieving school architecture that was novel, fresh and pleasing to the pupils and teachers. A brief review of the paper is presented hereunder.

Furthermore key findings from reports on the design and management of teaching and learning spaces in post-16 and higher education reported by JISC which were also based on the literature and publications was done and are presented in chapter three as they were considered to be similar and relevant pieces of work.

Clements-Croome et-al (2010) referring to the publication by the UK, Building Schools for the Future (BSF) programme reiterated that BSF's target was 'to achieve educational buildings that inspire new ways of learning and to provide 'excellent' facilities that benefit the whole community'. This they stated was hoped to be achieved by 'rebuilding or refurbishing every secondary school in England over a period of 10-15 years (DfES 2004b in Clements-Croome et-al, 2010). They reported that the BSF programme came about as a result of 'an increasingly widely held belief that older schools, as well as those more recently built or refurbished, were inadequate in their ability to cope with anticipated changes such as shifting pedagogy, curriculum and learning expectations' (Audit Commission, 2003 in Cardellino, Leiringer and Clements-Croome, 2009). 'There is, as such, a clear recognition that the public sector must be provided with environments that provide children with good places to learn and that schools should be designed to the highest quality' (HM Government, 2006 in Cardellino et al, 2009). Cardellino et al (2009) asserted that 'in this context the term 'design quality' had been given great prominence (CABE, 2003; DfES, 2004b; HM Government, 2006; CABE, 2006; OGC, 2007)'. Therefore after identifying the issues; the paper reiterated that the BSF programme outlined the following goals:

- improve learning and achievement for every child and young person;
- use new thinking and opportunities and be creative in designing for learning;
- enhance school diversity and parental choice;
- increase the use of schools by the community;
- seize opportunities through new technologies; and
- produce places for learning that are exciting, flexible, healthy, safe, secure and environmentally sustainable

The paper by Cardellino et al. (2009) had established a set of core principles of design quality that were grouped into: fitness for purpose (or functionality), efficiency and sustainability, build quality, flexibility and adaptability, aesthetically pleasing, contextual fit, inspirational, accessibility, and safe and secure environments. An explanation of these principles as stated by Clements-Croome et-al (2010) is presented below.

<u>Functionality and fitness for purpose</u>

A functional school building was seen as one which addresses the present and future changes in pedagogy through its design (e.g. DfES, 2002; Building Futures, 2004, OECD, 2004). That the building could be considered to be ‘fit for purpose’ was seen as a vital constituent of design quality which is important to the realization of a decent school building (Clements-Croome et al, 2010).

Flexibility and adaptability

It was thought that previous methods of designing schools were believed to have prevented the ability of adapting the buildings to meet future needs in education (Building Futures, 2004). Designing flexible environments was believed would enable adoption and adaption of the emerging changes in education (e.g. DfES, 2004 in Clements-Croome et-al. 2010 and Cardellino et al, 2009). Therefore, it was stated that ‘flexible and adaptable building designs, ensured ‘future proofing’ of the spaces and allowed for multiplicity of uses at various points in time (CABE, 2006). Furthermore, it was suggested that flexible or ‘agile’ designs would enable temporary alterations of layout and utility, while allowing for long-standing expansion or reduction (Building Futures, 2004 in Cardellino et al., 2009). It was however argued, that there was a need to create a balance between ‘flexibility, specificity and the functional’ parts of the school (tutoring areas) and social spaces which were also clearly expressed (Building Futures, 2004; CABE, 2006 in Clements-Croome et al, 2010).

Inspirational, safe and secure

Clements-Croome et al, 2010 explained that inspirational school buildings supported the delivery of teaching and learning effectively and inspired users to learn (DfES, 2004c; OECD, 2004; CABE, 2005; CABE, 2007 in Clements-Croome et al. 2010; Cardellino et al., 2009). It was said to be the main goal for creating spaces that nurture creativity, pleasure and a philosophy of learning. The research noted that the design of learning environments that have something unique about them would make the said spaces special - ‘spaces’ that become ‘places’ (CABE, 2006 in Clements-Croome et al., 2010; Cardellino et al., 2009). It was affirmed that this could be accomplished by designing environments that catered for a diverse array of experiences and activities and which comprises of every learning type: intellectual, physical, practical, social, emotional, spiritual and cultural (Building Futures, 2004). ‘Inspirational buildings support a diversity of learners and inspire not only the pupils, but also those who work and visit the school’ (Clements-Croome et al, 2010).

Aesthetically pleasing and contextual fit

Clements-Croome et al. (2010) and Cardellino et al. (2009) stated that ‘a building was considered to be ‘beautiful’ when it ‘lifts the spirits’ of those who come into contact with it’ (CABE, 2007). It was also noted that a building that was aesthetically pleasing was seen as one which did not only have the ability to produce a ‘sense of place’ within the school environment, but one that also as had a affirmative effect on the immediate society (HM Government, 2006 in Cardellino et al., 2009). In the same way, a welcoming and accessible school was perceived to produce a positive impact on the users of the building, as well as the neighbouring areas (DfES, 2002; CABE, 2006 in Cardellino et al., 2009)

Build quality and sustainability

Clements-Croome et al. (2010) explained that properly-designed learning environments ought to create a basis for extensive learning programs beginning from issues such as citizenship to sustainability. They stated that CABE (2006) presents the sustainable requirements of a building, with respect to aspects on the use of natural light and ventilation, other forms of energy as well as the option of suitable materials from sustainable sources, as a way to focus on and expand environmental issues.

Clements-Croome et-al. (2010) also referred to the recent ‘PhD study undertaken by Zulkiflee Abdul Samad at the University of Cambridge (Intangibles in the Building Environment, Explored through UK Primary Schools, 2008)’ in which twenty case studies of ‘new primary schools in England completed between 2001 and 2004’ were undertaken. Five key stakeholders were interviewed per school. They were: the Local Authority Education Officer, (representing the legal client) the head-teacher, and the chair of the governors, (representing the user client), and the architect and quantity surveyor (representing the design team).

The investigation centred on ‘the respondents’ perceptions of the contribution of the school premises (the building) to social outcomes’. such as ‘pupil attainment, pupil happiness, pupil attendance and truancy, staff recruitment and retention, staff morale, supervision of pupils, school image, community involvement, flexibility and adaptability of the building interior for different educational styles, safety and security, and the potential of the school building as a teaching tool’ (Clements-Croome et al, 2010).

Clements-Croome et-al (2010) reiterated that the interview questions covered issues such as whether:

- the key criteria for the school had included any or all of these social outcomes
- these had been cited in the briefing to the design team and/or in project documents
- there had been discussion of any or all of them during meetings between client and designer during the design process
- respondents agreed that good design can bring intangible educational benefits
- making requirements about these intangibles explicit helps to elicit higher standards of design from design teams
- Better valuation methods for intangibles encourage capital investment to ensure they are delivered.

The study also enquired if the end-users and stake holders had attempted to place a value on these outcomes so as to ensure sufficient costs were provided in the school construction budget to ensure their delivery in practice.

Interviewees were also asked about pupil attainment and educational outcomes, and how they viewed the achievement of social outcomes in the school; as well as whether they believed the school design was important in influencing outcomes.

Of the twenty case studies, ten schools were selected for detailed analysis – specifically those where the users (head-teacher, governor) had high perceptions of the potential benefits from good design, and those where perceptions were lowest. The opposite extremes of the spectrum provided dramatic differences in stakeholder perceptions.

Clements-Croome et-al (2010) reported that several conclusions came up from the study (Samad, 2008). The most vital one was that situations where 'stakeholders (clients, users and designers) had a low perception of the connection between good design and educational attainment, poorly designed buildings were the likely outcome'. Unless and until stakeholders' perceptions are raised, the UK building programme was likely to produce a large number of schools 'perhaps a quarter of the total number on the evidence reported by Samad (2008) that are not well designed and disappoint their users. (Clements-Croome, et-al, 2010)

The lessons learnt from the review presented by Clements-Croome et-al (2010) on the BSF initiative along with the Cambridge study (Samad, 2008) are to be used as reference points for this on-going study as they may be a useful guide in the process of achieving the third objective albeit with respect to the users of learning spaces in post 16 higher education and universities not schools as was the case reviewed.

1.5.4 Research Objective Four: -To develop a framework for the design of e-learning spaces

The development of a model framework for the design of e-learning spaces was achieved by review of similar research, analyses and collation of research findings and good design guidelines identified. These were further discussed in the methodology and analyses chapters.

1.5.5 Research Objective Five: To evaluate the framework and develop into an E-learning 'How –To-Design Guide'

An evaluation of the framework was done before it was adapt it into an e-learning space design how-to-guide. This was done in order to validate the framework and the process used to developed it as it was expected that the outcome will serve as a benchmark/resource point for those HEIs who wish to undertake construction projects of future e-learning space design

1.5.6 Problems and Hindrances to Achievement of Research Aim and Objectives.

- Time constraint for executing the set task. (3yrs seemed a long time away but then time went by so fast that after two years it began to appear as though the time allotted was inadequate)
- Obtaining relevant data from literature review and desk studies and gathering them together into a research work to be submitted as a thesis

- Getting access to the relevant sources and persons for the interviews, questionnaire survey and case studies during the field work

- Obtaining the feedback from the case study drafts from the participating institutions and their consent to use the data obtained in the research brought about some unexpected delays.

1.6 RESEARCH APPROACH, METHODOLOGY AND CONTEXT

The academic and intellectual context in which the hypothesis is located is based on a **philosophical approach** that combines inductive and grounded theory methods (Kelle 2004; 2005).

1.6.1 Overview of Research Approach/Methodology:

Since this research work involves; the identification of a problem; definition of research questions; and systematic data collection from literature reviews; thorough observation and documentation of case studies; and interviews, in order to develop a theory and thus a framework; which will subsequently be adopted into an e-learning space design toolkit, the inductive and the grounded theory approaches were used. In order to achieve the research goal, a mixed method research approach was adopted.

The overall steps used for the research method involved both quantitative and qualitative methods of descriptive and collective case studies. This was because a holistic, in-depth investigation of the subject area was required (Yin 1994, 2009). These were then analysed, before a frame work was developed and evaluated. Finally conclusions and recommendations were made; and the research findings would be disseminated.

1.7 RESEARCH BENEFITS/OUTCOME

This research will lend credence to previous research into the impact of learning environments on students by CABE (2005) which showed three main areas of influence: motivation of their work, facilitation of inspiration amongst students and thirdly provision of support facilities relevant to the course content.

The research outcomes will also impact on future space design, for increased learning flexibility; providing virtual work spaces thus informal learning, creating fun and interesting dynamics between students. JISC (2006) stated that the proper design and management of learning spaces should promote interactive and collaborative learning.

1.7.1 Financial Benefits

As stated in the LGMF project bid template (2006), the good practice evidenced could be of potential financial benefit to the HE sector in several ways. This study would make a significant contribution.

Their example states that it is possible that design incorporating an IP “voice over data” infrastructure for e-learning could reduce installation costs because of cabling and cabling management efficiencies.

FM is also expected to become more efficient with this technology and could result in energy savings when implemented in the future design & construction of intelligent buildings.

IT and e-learning infrastructure are now critical investments in all major building projects. A capital saving of some 1% would equate to approximately £15million/annum with consequent revenue deductions. (Source: statistics obtained from LGMF project bid template and HESA).

1.7.2 Dissemination

The dissemination of research findings was done through poster presentations, paper publications, reports at conferences, seminars, and online journals as well. Participation in the Postgraduate (PG) poster design competitions was done in the first, second and third years of the research along with attendance of several skills development training sessions organized by the PG School.

PowerPoint presentation at the BEERs seminar on research progress on 16th December 2009 at the University of Wolverhampton was done. Submission of 3 abstracts and papers for conferences were done. (The conference gave the opportunity to network with other professionals with similar interests as it were and the peer review process also helped to validate the key findings and main issues investigated in the study as well as the research methodology and approach adopted).

Some examples of papers written /abstracts submitted from this study are as follows:-

- Critical issues in designing and managing e-learning spaces in HEI- Abstract accepted for the 7th international postgraduate research conference in the built and human environment, Salford UK, March 2007

- Analysis of Components of good practice and testing their validity with regards to design across selected HEIs – (this was a report submitted to HEFCE, 2007)

- A review of ‘The evolution of Learning spaces and designing for the future learner; Critical issues affecting Learning Space Design and Delivery;

- Identification of user patterns and requirement within the physical e-learning environments. (Power point presentation, University of Brighton, 2010 July)

- Towards Effective E-learning Space Design on HEI campuses- Abstract and paper accepted and presented at AISBEE, UK Jan 2010

• An Innovative approach to e-learning space design in HEI construction.- Abstract and Paper included in proceedings for 6th International Conference on AEC, Pennsylvania, USA- June 2010

• Impact of Educational Systems on the Design of E-Learning Spaces in Higher Education Institution Campuses (2011) Journal of Architectural Education http://www.jaeonline.org

• Impact of E-learning on Space Design and User's Requirement within Higher Education Institution Campuses (2011) The International Journal of Art and Design Education http://www.wiley.com/bw/journal.asp?ref=1476-8062

• Critical Analyses of Success Factors for E-Learning Space Design Adoption and Implementation in Higher Education Institutions: Users, Stakeholders vs Design Issues (2011) www.itcon.org - Journal of Information Technology in Construction

1.7.3 Other Project Deliverables

To successfully document, evaluate and share the knowledge from the case studies via a web based audio visual library of good practice. Thereby providing access to many institutions who require knowledge and guidance in this area of designing for their own future implementation and adoption.

To attempt to successfully fill the past knowledge gap in this area which had led to ambiguous design approaches; by defining a novel and new method for e-learning space design particularly in HEI sector.

To fulfill requirements of PhD, award by producing a well written, coherent and succinctly presented thesis that expresses the researcher's observations, findings and conclusions with an objective and unbiased approach.

1.8 THESIS STRUCTURE

The Thesis structure developed for the research topic A Novel Methodology for E-learning Space Design in HEI campuses is divided into three sections comprising of ten chapters. Each Chapter addresses an aspect of the research endeavour undertaken with the hope of presenting the envisaged outcome of the research work; almost like an executive summary of some sort.

1.8.1 Section One:

This presents an introduction and critical analysis based on reviews of the general subject area from chapter one to five.

Chapter One: - this is basically an introduction to the research scope; it presents a general background and rationale behind the research. An overview of the research into e-learning space design on HEI campuses, with an explanation of how the research focus emerged is clearly presented. A synopsis of the aim and objectives of the study and how these were developed in line with the research topic.is provided, along with the research questions and hypothesis, research benefits, research methodology developed and used as well as the philosophical context. The problems that could pose hindrance to achievement of the research aim and objectives were identified. Secondary objectives, other deliverables and perceived learning outcomes and contribution to knowledge were also briefly highlighted. Chapter one concludes with a thesis structure outlining briefly what each subsequent chapter contains.

Chapter two contains literature reviewed towards justification of research in an attempt to present evidence on the viability of the research endeavour and the direction taken as well as an overview of research processes undertaken. This chapter also looked at the problems and the possible solutions to the problems identified were also discussed.

Chapter Three:- presents an in-depth analysis of the subject area initially outlined in chapter one i.e. in the form of review papers on the evolution of the learning space and a critical analysis of issues that affect the good design of e-learning spaces with respect to users' requirement, learning patterns, technological advances and related factors. Also a description of how the research identified best practice examples of good design in HEI construction from desk studies is discussed. This is in line with the first objective of the study which is to carry out desk studies and investigations into published academic work, literature, books, journals, conference papers and materials within the scope of designing e-learning spaces in HEI. Also this chapter contains analysis of the theoretical background of the current thinking based on publications from industry practitioners on the design of e-learning spaces in HEI.

Chapter Four: - like the preceding chapter presents other aspects of the literature reviews carried out. In chapter four are findings on the history and meaning of education, the historical background of university buildings from the beginning of its existence till the

21^{st} centuries and a review on the origin and history of higher education institutions (HEI) in general.

Chapter Five: - focuses on the review of the development of educational systems and the relationship between educational systems in general with particular reference to e-learning space design; also how all these affects the design elements or variables of general teaching and learning spaces such as materials and fittings, layout, aesthetics and some other important factors that determine the final outcome of these spaces as well. For example, the relationship between cultural, social, economic and human factors as it were. The chapter then examines similar research in form of case studies of learning environments with respect to design implementation, guidance, strategy, refurbishment, in order to ensure that the task identified is a worthwhile endeavour that will address the current knowledge gaps within the subject area being undertaken

1.8.2 Section Two:

This focuses on the research methodology developed which then led up to the field work done. It presents the primary data from some survey outcomes and case studies conducted. It comprises of chapters six to eight**.**

Chapter six: - is divided into two parts, the first is about the research methodology developed and the second is about the field work done. Part one explains the ethical considerations, the why? what? and how? of the research method chosen; looking at the suitability of either the qualitative or quantitative analysis options with the aim of getting a general understanding of what the pros and cons of each approach were and how these were to be used to achieve the research outcome. It then presents the argument for why the researcher decided to use a mixed methods research approach. Part two is dedicated to the field work done during the research. It presents the development of the tools used; criteria for case study selection, the pilot studies, questionnaire survey and the structured interviews. How all these were then used in the research along with the outcome of the e-learning forums done earlier at the onset of the research and how the forums helped to inform the research direction into the investigation of case studies and interviews done in the study of e-learning spaces design on HEI campuses.

Chapter Seven: - After the methodology chapter above, the primary data from some results obtained are presented followed by a discussion on how these are dealt with in relation to the research focus identified at the beginning. This is in order to support the justification and validity of the study presented and the possibility of an innovative and novel approach to the proposed framework being developed

Chapter Eight: - This is the chapter dedicated to the outcome of the selected case study/site based analysis of the HEIs visited, the collation and analysis of the entire data collected with the explanation of how each tool identified in the previous chapter were used for testing, measurement and comparing the results in order to eliminate any bias and present a novel work that is based on an original research endeavour which can then be regarded as an honest contribution to knowledge in this field.

1.8.3 Section Three:

This is the analysis of the field work, how it was used in the development of the framework and then the final outcome of the study. This starts in chapter nine and concludes in chapter ten.

Chapter Nine: **-: -** this is dedicated to the analysis of the findings and the development of the design framework proposed and how this can be adapted into a "How to design tool guide". The re-evaluation of the research hypothesis, research philosophy, context and research questions that evolved from the beginning of the study and from the reviews carried were discussed and developments /inferences from this process was presented.

Chapter Ten: - this is the final chapter and it is basically a presentation of the conclusion from main findings of the research. The researcher's concluding arguments and recommendations; the implication of the uptake of the e-learning space design framework developed is discussed and suggestions put forward for possible further direction of the study with respect to the future of e-learning space design in HEI construction and the Industry at large. Some conceptual designs and 3D visualisations for future e-learning space design of HEI spaces were produced as examples from the framework that was developed.

1.9 CHAPTER ONE SUMMARY

A presentation and explanation of the research aim and objectives identified and how these were developed in line with the research topic was the focus of this chapter. The research questions and research hypothesis which evolved were highlighted. Findings from literature reviewed along with all the steps taken to achieve the outlined objectives and answers to research questions were explained. A review of literature on the key areas of the research interest with respect to users requirement and the identification of what user's want and require within e-learning spaces indicated that some drivers for change, based on the users' social expectations and requirements were-: i) the need for motivational, ii) creative, iii) technology-rich learning spaces that would support collaborative, personalised as well as blended models of learning.

Literature reviews also indicates that there was an increasing demand for 'personalised and flexible learning provision and a corresponding user requirement for the design of flexible and innovative learning spaces; which should be centralised, accessible, multipurpose in nature, in order to meet the demand for increase in space utilization. Other user requirements were the need for inclusivity. Researchers argued that there was a need for the university to provide support for a widened access and participation of learners.

JISC (2006) states that in responding to user requirement, future spaces and current designs showed an increasing support for social, collaborative and blended models of learning, more embedded use of audio-visual technologies, increasing hybridisation of spaces, flexibility in design, fittings and furniture to ensure sustainability. Gale and Williams (2006) stated that the solution would be the move towards intelligent designs for intelligent buildings. Reviews indicated that the 'process of design was also changing' with respect to 'the co-operative involvement of services to provide comprehensive e-learning spaces'.

In conclusion, the thesis structure was outlined to give an overview of the entire study undertaken and the description of the work done to achieve the goal of the research. The thesis in itself is an attempt by the researcher to present honest reviews, arguments, concepts and creative ideas arising from the researcher's investigation on the subject area of e-learning space design on HEI campuses. This work was prompted by an earlier research interest into the design quality of e-learning spaces in Higher education Institutions. The issues of space design problems with respect to user requirement and client satisfaction, stakeholders' expectations and existing industry standards were identified as the core area to be examined with the aim of giving some meaning/validity to the underlying principle of the research and the hypothesis put forward in this study.

Furthermore, it was expected that this research will be of significant benefit to the HE sector and the Construction Industry knowledge base for identifying good practice and providing sector-wide guidance for the design of e-learning environments; as it moves towards achieving inclusive design and the delivery of appropriate spaces within HEI campuses.

Research shows that the advance in technology now makes it possible to be more "adventurous" with e-learning spaces. Ways of encouraging group working, access for all irrespective of one's ability and the use of supporting AVA as process of design is currently changing with regards to the provision of services that improve e-learning space design.

CHAPTER TWO: - TOWARDS DEVELOPING THE RESEARCH FOCUS

2.0 INTRODUCTION

Chapter two contains the findings from literature reviewed towards justification of research as well as an overview of design in general. This chapter also looked at the problems as well as the possible solutions to the research endeavor. Other aspects which were flagged up during the desk studies and have been considered to have a direct or indirect impact on the design of e-learning spaces and facilities. These were also investigated in the light of the research aim and are discussed below. However, these are not exhaustive but were selected as they were thought to be of uttermost relevance to the research focus.

2.1 DESIGN IN GENERAL

Cambridge Dictionary of American English (2011) defines 'Design' as a noun which 'informally refers to a plan or convention for the construction of an object or a system (as in architectural drawings, engineering drawings, business process, circuit diagrams and sewing patterns)' while Oxford English Dictionary (2010) explains that "to design" '(verb) refers to making plans'. Ralph and Wand (2009;pp103-136) states that there is no 'generally-accepted' definition of "design" but that 'the term has different connotations in different fields and disciplines such as Applied arts, Architecture, fashion design, Graphic design, Industrial Design, Interior Design, Product design, Process Design, Engineering Design, Web Design and Service Design.' But noted that to design can also involve directly constructing an object (as in pottery, engineering graphic design etc.)

Architectural Design is the discipline that is relevant to our study; therefore a general understanding of design in this context has been presented hereunder.

2.1.1 Architectural Design

From the first written work on architecture i.e. 'De architectura', by the Roman architect Vitruvius, in the early 1st century CE. 'A good building should satisfy the three principles of *firmitas, utilitas, venustas*, which means:

- Durability – it should stand up robustly and remain in good condition.
- Utility – it should be useful and function well for the people using it

- Beauty – it should delight people and raise their spirits. (Vitruvius, 1960)

In the 19th century architect Louis Sullivan, promoted a superseding principle to architectural design: "Form follows function" (RIBA, 2002). Rowland and Howe, (2007) argue that even though the idea that ‘structural and aesthetic considerations’ ought to be relative to functionality was widely accepted albeit with both ‘popularity and skepticism’, they asserted that the idea of Louis Sullivan influenced the introduction of the concept of "function" in place of Vitruvius' "utility". "Function" in architectural design was then understood to include all aspects of the ‘use, perception and enjoyment of a building, not only practical but also aesthetic, psychological and cultural’ (RIBA, 2002).

In the 20th century, the concept of ‘Sustainability’ was added to design structure and function (Adams, 2006). It was the consideration that sustainability was required to meet the demands of a building design (RIBA, 2000). Thus “Sustainability” as a term became shorthand for sustainable development.

“Sustainable development” came to represent the unification of 3 “zones of salience”: 1) social progress, 2) environmental preservation and 3) economic development (Adams, 2006). This is represented in Figure 2.1.

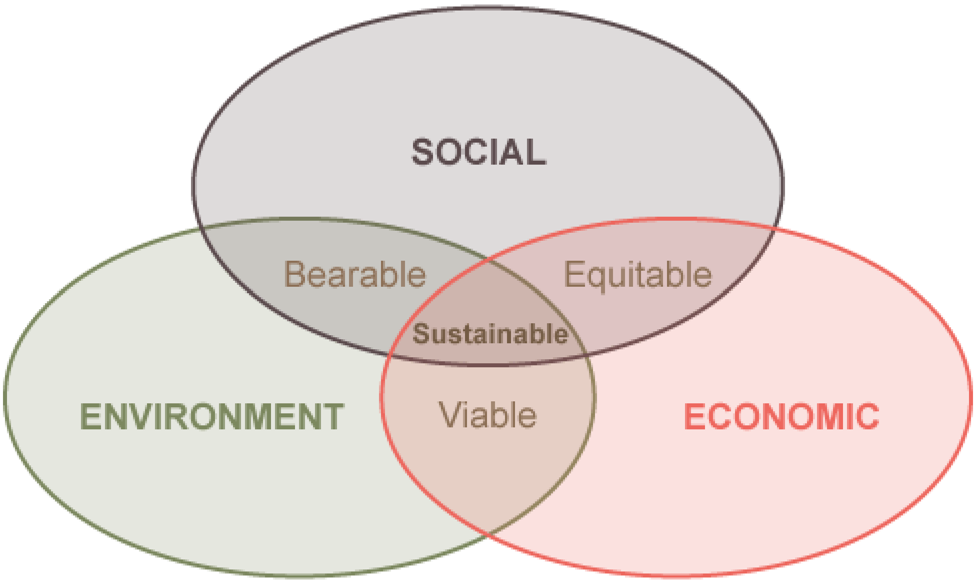


Figure 2.1: Three Traditional Zones of Salience in Sustainability

Source: Adams (2006)

Design in ‘the context of the technology supported teaching and learning spaces which is the focus of this research can be defined as the creation for spaces that are ‘beautiful, inspirational, adaptable, sustainable, inclusive, fresh, safe, flexible, ICT enabled, multi-user, fun, delightful, curved, growing and natural’ (DfES, 2003).

An example of where the design of teaching and learning spaces incorporated the above design considerations were ‘The Classrooms of the Future Initiative’ which started out with 30 pilot projects in which the teachers and pupils were involved in developing design concepts and ideas along with architects with the aim of challenging current thinking on school building design. (DfES, 2003) David Miliband, the DfES Ministerial Design Champion then stated that there was a need to try out new ideas and ways of ‘designing inspiring buildings that can adapt to educational and technological change…’ it was his view that ‘Flexibility’ was key, because ‘whatever visions of education we design our buildings around, we can be sure that they will need to perform in a very different way in a few years’ time (DfES, 2003).

From the forgoing it can thus be understood that in order for space design to be functional certain criteria must be in place this were summed up by the DfES (2003) Report as the following:

● the provision of buildings and facilities that will inspire and motivate users to maximize individual and collective educational potential’; and

● to ‘unlock the considerable educational potential of space, resources, environment and learner’s behavior, currently not possible in the traditional school design.

The educational concepts that steered the spatial design included the following:

● a useable and adaptable teaching space, which is at the same time special;

● a set of spaces that are sustainable in use over a long period of time and can accommodate the changing nature of technology;

● General improvement in terms of daylight provision, ceiling heights and environmental control;

● a set of interlocking spaces that vary in scale and optimize the use of external covered space;

● Spaces which nurture new relationships in learning and teaching. The function of design within the context of space design of e-learning environments can be seen through the example of the similar work discussed.

Therefore, Space Design should exhibit the attributes of Functionality, Aesthetics, Build impact Flexibility and Sustainability. Others are provision of adequate Ventilation, lighting, Thermal Control, Acoustics, Space layout, Fittings, Fixtures and Equipment.

2.2 JUSTIFICATION OF RESEARCH FROM CURRENT THINKING ON LEARNING SPACES IN HEI.

JISC (2006) reiterated that physical learning spaces are unique instruments for current revolution, as the change they bring about will in turn change users' performance stating that "Technology will change faster than you imagine" A view supported by Alshawi, Goulding, and Faraj (2006).

Alshawi et al (2006, 52) stated that 'the specific advantage e-learning has to offer is now considered an important tool for meeting the challenges of the 21st century as new and developing technologies are revolutionising the way instructional content is presented and shared. Thus the creation of an effective e-learning space is critical to the delivery of technology supported learning, (TSL) (Newton, 2005)

It is expected that the redesigning of spaces today should reflect future directions and technologies instead of current technology only in order to accommodate the changes. This is based on the assumption that "a small-scale highly equipped space can act as a catalyst for wider change and become a test-bed for new pedagogic approaches" (JISC, 2006; JISC, 2008)

New buildings have to be seen as 'learning based' rather than 'subject based'(Gale, 2006) as recent research regarding the influences of buildings on students showed three main areas of influence, 'First, they helped to motivate students in their work. Secondly, they facilitated inspiration among students, and thirdly they provided key facilities critical to the course content (CABE, 2005; 39).

Furthermore, the importance of involving students in the design of the buildings was emphasised as there were often differences between staff and students' spatial needs (CABE, 2005; 24).

It can be argued that the HEI sector is yet to define the most appropriate, effective design parameters for delivering e-learning spaces. Those which do exist, focus mainly on cost, budget and timely delivery i.e. the process only not the product. New methods and standards are therefore required to address the above issues and other problems of space efficiency, effectiveness, quality, innovativeness, and performance and user satisfaction in the designing of e-learning spaces.

Watson (2006) expressed the opinion that an educational building was an "expensive long term resource" whose space design should show the following important characteristics-:

Flexibility – "to accommodate both current and evolving pedagogies"

Future – proofed – "to enable space to be re- allocated and re-configured"

Bold- "to look beyond tried and tested technologies and pedagogies"

Creative- "to energise and inspire learners and tutors"

Supportive – "to develop the potential of all learners" and

Enterprising – "to make each space capable of supporting different purposes."

Three key factors were considered to be common to all: (1) distance between the instructor and the student; (2) opportunities offered by technology for different delivery techniques (3) and expectations on the student to work largely independently (Teles and Duxbury, 1992 in Neville and Heavin, 2004).

Educational buildings ought to encourage learning. They should take care of the needs of every student and staff member. They ought to also be a source of pride and a valuable asset to the society. (Watson, 2007) the learning environment should encourage co-operation to achieve a common objective (Johnson and Johnson, 1990; Brown and Voltz, 2005)

McCormack et al. (1997) in Neville and Heavin (2004) identified benefits of the creation of e-learning management system (LMS) as the following: (1) increased participation; (2) increased flexibility; (3) increased variety; (4)increased expectations; (5) changing nature of knowledge; (6)increased competition;(7) increased learner control for the customer or student.

Weiss (2007) stated that 'learning was being revolutionised' and summed it up in table 2.1

Table 2.1 Revolution of Learning

from INSTRUCTION	to LEARNING
• teacher-centred	• learner-centred
• face to face	• digital
• synchronous	• asynchronous, web-based
• solo learning	• group learning
• group course, autumn start	• individual courses, start anytin
• once only	• lifetime education
• single medium	• multi-media
• self contained	• partnerships
• local context	• global context

Source; Weiss (2007)

The above findings show that the technology uptake and the e-learning mode of delivering taught courses has been analysed and considered to be generally beneficial to students. So much had been done with respect to the different ways of teaching and learning through the use of technology. However that cannot be said about the design of the learning spaces that ought to accommodate this new technology. (JISC, 2005); (CABE, 2006); (HEFCE, 2005); (Watson, 2007).

2.2.1 E-Learning Space Design vs. the Strategic Vision of HEIs

According to Watson (2006) properly designed spaces have a motivational effect; therefore engaging learners in the phases of the design process is thought to be important. Smith (2006a), defined an e-learning space as a space that is technologically supported for learning, designed to provide simultaneous support for face to face (f2f) and virtual learning and also allow for ground-breaking as well as experiential learning. This reiterates what had been stated by Watson (2006) concerning the requirement for rich learning spaces to reflect an institution's image, ideas and policy on education.

Smith (2006a) noted that there was no single outline for the design of learning and teaching spaces but what was significant was for the designs of physical spaces to be related to an institution's strategic vision for teaching and learning and to have these clearly defined within the design proposed. Smith (2006) observed that all stakeholders, including students and staff should be made aware of the vision so as to ensure effective communication from the onset. It was also an assumption that the 21st century would experience greater demands for achieving effective and efficient space design and use in higher education institutions.

JISC (2006) agrees with this, as it stated that the requirement of learners should underpin the development of strategies for teaching and learning, and learning space design. It also reiterated that it is important that designs of physical spaces should be related to an institution’s strategic vision for teaching and learning, and that this ought to be expressed in every detail of the design and shared with all stakeholders, as well as learners.

Newton (2005) mentioned that current research showed that the use of “Institution-wide or Faculty-wide managed and virtual environments” along with access to Internet facilities by Higher Education Institutions (HEIs) have increased in recent years to provide a framework for Technology Supported Learning (TSL). It can thus be argued that the creation of an effective e-learning space is essential for the deliverance of such learning environments.

However, new research by JISC (2006) showed that there still existed a challenge for institutions that aspired to manage the transformation in their learning approaches. This also applied to those who desired to make investment decisions on new build projects while seeking to increase their understanding from the knowledge and experience of other HEIs. (Using them as benchmarks for their own progress and success during the implementation of these changes).

Therefore, it is expected that the redesigning of our learning spaces at the moment ought to reflect future directions and technologies instead of current technology as it were. This thought is from the assumption that “a small-scale highly equipped space can act as a catalyst for wider change and become a test-bed for new pedagogic approaches” (JISC, 2006).

Furthermore, Newton (2005) agrees with the statement that “HEIs have started to develop and depend on Technology Supported Learning, though without a sector-wide approved guideline for the design of future e-learning spaces.

Cooper, Evans, Boyko and Adams (2009), argues that "to be sustainable, design professionals must develop innovative and creative solutions that are able to tackle social, environmental and economic issues at the same time – and then communicate these solutions effectively to planners, developers and policy makers". This also includes HEI as well.

2.2.2 Philosophies of Education and Institution's Vision

Buildings that are built today are expected to still be functional several years from now and therefore are required to remain fit for the present functions for which they were built in the first place. (Watson, 2007)

Watson(2006) writing in 'Building the Future of Learning' expressed his opinion about the impact of e-learning on the design of buildings, stating that 'could it be that in our excitement about e-learning we forgot about buildings? With the advent of the personal computer and ubiquitous networks', he asked 'were we enticed into thinking that they would suffice and learning would follow removing the need for places and communities for learners?' Watson (2006) further asserted that the world (we) 'now seem to have woken up' reiterating that there was a huge 'resurgence of interest in new buildings (Clements – Croome (2004)' as was evident in the Universities, Schools and Colleges of the twenty-first century. Gale (2006) and Watson (2006) both argued that while this was a genuine occasion to 'build' our learning futures, if the new interest was only focused on building structures alone, it was a lost and misguided opportunity. But that if the interest was also focused on change, 'place and community' this would result in the creation of the connected physical and virtual learning society which was the desired outcome.

Watson (2006), also asserted that the new twenty-first century buildings and renovated spaces ought to reflect our educational approaches and philosophies, a view also expressed by JISC (2006), adding that it was therefore most vital, that they should not hinder the possibilities of tomorrow. Watson argued that in order words the buildings that are built today could stand as a hindrance to what may become the main approach for teaching, learning and working in the future. He reiterated that therefore, our buildings ought to encompass educational philosophies, with creative technology and architecture to deliver the learning expectations desired.

Watson (2006) cited the example of The Saltire Centre at Glasgow Caledonian University, opened in January 2006, as an example of a structure that was began from the principle of a building that would be flexible such that it will not hinder the future possibilities. The building, he explained was constructed with a large number of spaces, which embraced the different learner attitudes and supported the idea of learning as a social procedure which placed the need for humans to socialize, interact and communicate at its center. Watson's paper described the case study of The Saltire Centre as one which demonstrated how certain relevant and current initiatives in educational thinking could control the type of learning facilities that was built.

2.2.3 Type of E-learning Equipment and the Impact on Space Design

In another sense, research shows that the impact of e-learning on facilities and design could also be as a result of the type of e-learning technology equipment being used or adopted and therefore the design of the space it is meant to occupy would be a consideration with respect to every design parameter that will enhance its success because the effectiveness of the designed space or environment would be affected by the equipment. A simple example is the installation of desktop computers within a study environment and the manufactures' specified requirement for the installation of automatic temperature control system and adequate ventilation devices that will keep the PCs at the required temperature without posing a hindrance to the users of the space with respect to the conduciveness of the ventilation or air temperature for users in that environment as well. So the effect of e-learning on space design is not dependent only on the academic requirements of users or the educational philosophies of the institution.

2.2.4 End Users of E-learning Spaces and Their Effect on Space Design

It is important to understand who the end users of e-learning spaces are. The term 'end users' in this study refers firstly to students of all ages and categories from those students in schools to colleges, universities, higher education, further education and students on long distance programs as well as the staff and members of the learning community (UNESCO, 2010). The general mode of education provided may differ; i.e. full time or part time depending on the type of programme, availability of resources, time and individual preferences of the student (HEFCE, 2010).

Secondly it can be generally assumed that another category of users would be the teachers, tutors, lecturers and Staff of academic institutions or organisations, instructors, office staff, facilitators and trainers as well (CABE, 2010).

And thirdly a user may generally be considered to be any person that is capable of and interested in learning or acquiring some sort of skill, knowledge or information either through a formal process such as an academic institution or informally through other means. (www.constructingexcellence.org.uk)

The users of learning spaces and their attitude towards learning, their learning styles and patterns was also considered to be a factor that affects the effectiveness of the design and the type of learning spaces provided. (Ramsden, 2005; Biggs, 2003) A brief review of some research publications in this regard is presented hereunder.

Gale (2006) In a paper titled 'flexible learning needs flexible buildings' reflected on how university authorities, architects, engineers, educational developers, staff and students worked hand in hand to plan and deliver buildings which were a flexible framework for enabling and creating future learning and teaching. The paper then outlined some of the issues that had been considered with respect to current and future students' attitude and its impact on space design planning and future proofing at the University of Wolverhampton. These are discussed here;

I) The changing or increasing staff- student ratios

II) The changing student demography and design

III) The changing student technology

IV) The changing student patterns- student perceptions of learning

V) The change in planning relationships

2.2.4.1. The changing or increasing staff- student ratios as this also had implications for buildings. The article explained that the 'one-to-one tutorial facilities within individual staff rooms' were gone as the rooms now usually had between four to five staff in them. The implication it explained from the feedback that was received was that with 'fewer phone calls and more e-mails this can work and can lead to less isolation, especially for new teaching staff.' Gale (2006) believed that however, spaces where people can talk individually or in small groups with students was still required, 'so what once would have been a corridor of individual staff rooms becomes a building of joint staff rooms with a few bookable "interview room" enabling us to make more efficient use of our space' Gale (2006) also noted that;

2.2.4.2. The changing student demography and design which the paper stated according to DfES (2005) were increasing by the day. Watson (2007) also supports this view asserting that 'we need to design spaces that addressed the greater diversity of students that we have in our universities, using our imagination to design places that motivate, engage and inspire our students enabling them to make the best use of their talents' Gale (2006), noted that as students always 'connect' with the university in diverse ways, 'flexible learning needs therefore required flexible buildings'. Watson (2007) observed that 'surprisingly though it might be, there is evidence to suggest that students, even in the net-connected Google generation, still value place and are attracted to inspirational places.

2.2.4.3. The changing student technology was also considered to be an issue that affected the design of learning spaces. 'Gone are the days when assessing the quality of the student experience focused almost exclusively on undergraduate teaching quality. Today's students expect a certain level of computer information technology provision, and library administrative supported' (Ramsden, 2005). Gale (2006) explained that this meant that for majority of 'our students, modern technology is not an add-on it is an integral part of their existence.' Gale also reported that the implication of this was that 'we are creating a learning environment which not only gives students access to the technology, but also allows them to bring their own experience to it'. It was Gale's opinion that therefore the separation of the teaching spaces from the learning spaces was no longer the practice as it was in the past. Gale asserted that 'the technology is not in a separate "IT lab" it is in a walk-in learning space. Our current students want less of the individualised "study carrel" existence. However, it was her opinion that this was not to negate the provision of 'quiet non-technical spaces for the learners who required it, but that there was an increasing trend of shifting closer towards 'the other end of the continuum where the space is open, flexible and technical.'

Further to this issue of changing student technology and its impact on the design of learning spaces, in 2008 JISC released a publication from the first phase of a four year enquiry into undergraduate post-graduate and adult learners' experiences of e-learning titled 'In Their Own Words' the publication reported by Ross Smith stated that the results showed that ‘learners are already seeking both choice and control when it comes to the technology and are mixing and matching personal and institutional tools with skill’ it also supported Gale’s view that technology was not an ‘add-on’ JISC states that ‘technology is central to their lives and therefore also to their studies, but JISC (2008) noted that ‘increasingly the boundaries between study and other aspects of their lives are being eroded’ but this seems to imply that the current students have now gone beyond Gale’s opinion about the shift towards the ‘open, flexible technical spaces that learners want to further include learners bringing in their personal lives into the study space as well.

2.2.4.4. The changing student patterns- student perceptions of learning: Gale (2006) referring to the new build executed in the University of Wolverhampton explained that when the buildings were being designed, they had looked closely at the way their students wished to study with respect to their behaviour within the learning spaces. In order to carefully note which spaces they chose when they were not being formally taught. Gale observed that there were no longer huge separation between eating, drinking and working. The effect she noted was that the traditional rigid spaces were not removed totally but were becoming fewer, while the ‘flexible study/eating/wireless/laptop spaces were becoming larger’. According to Brett and Nagra (2005) in Gale (2006) spaces were said to match students’ perception of learning while Biggs (2003) stated ‘that for learning to function at its optimum level there should be student interactivity’ Gale (2006) believes that if this were to be the case, there was therefore a need for the design to take into consideration the pedagogic principles as well.

2.2.4.5 The change in planning relationships all affected the space design in this regard. Gale (2006) referring to some projects which were at that time being executed at the University of Wolverhampton reiterated that in planning their latest building, they had some groups working on the same building from other viewpoints. Gale (2006) stated that ‘many different kinds of people are needed to plan design and maintain a successful learning building’; that further to this assertion workshops and business meetings were held not in the board rooms alone but that they met in learning and teaching places and that they also just didn’t just work on paper or on screen, but that they also went, ‘looked and measured the reality and asked questions about how the space looked and also about what it felt like. Gale (2006) reiterated that they ‘were not just interested in drawings but that they were interested in ideas, and they had set up ‘sub-sub meetings’ comprising of various staff groups who looked at the different teaching and learning spaces across the entire building. That as it were some of the new designs required staff to teach in new ways and as such they had set up as part of their building projects 'mock-ups of teaching rooms and equipment along with planning of training sessions for the new technology use alongside these they worked with designers and architects as well.

2.3 WHY RESEARCH INTO E-LEARNING SPACE DESIGN

"Architecture is generally conceived-designed-and realised-built-in response to an existing set of conditions. These conditions may be purely functional in nature, or they may also reflect in varying degrees the social, political and economic climate. In any case it is assumed that the existing set of conditions-the problem- is less than satisfactory and that a new set of conditions – a solution- would be desirable. The act of creating architecture then is a problem- solving or design process. The initial phase of any design process is the recognition of a problematic condition and the decision to find a solution to it…

A designer must first document the existing conditions of a problem, define its context and collect relevant data to be assimilated and analysed. This is the critical phase of the design process since the nature of a solution is inexorably related to how a problem is perceived, defined and articulated…"

Francis D.K. Ching-1943

2.3.1 Problem Identification

From literature reviewed, Smith, (2006a):

- Noted that there was no single outline for the design of learning and teaching spaces;
- It was significant for designs of physical spaces to be related to an institution's strategic vision for teaching and learning.
- To have these clearly defined within the proposed design.

JISC (2006); JISC, (2007) agrees and indicated that:

- The views of learners should underpin the development of strategies for teaching and learning, and learning space design.

- It is important for designs of physical spaces to be linked to an institution's strategic vision for teaching and learning, and that this ought to be articulated in every detail of the design and shared with all stakeholders, including learners.
- That there is still a challenge for HEIs that wished to manage the change in their learning approaches.
- This was also found to be the case for those who wished to make investment decisions on new facilities, and gain access to the knowledge and experience of other HEIs (as benchmarks for their own progress and success during the implementation of these changes).

Furthermore, Newton, (2005) observed that HEIs have begun to develop and depend on Technology Supported Learning, though without a sector-wide approved standard structure for the design of future e-learning spaces.

According to the AMA report for the Scottish Funding Council (2006), staff members were found to be consistently more dissatisfied with teaching and learning spaces than students before the learning environment were improved.

The report noted that the main causes of dissatisfaction from both groups were ambient environmental factors such as air quality, noise levels, ventilation, temperature, lighting and lighting control. Evidence suggests that these factors have an impact on learning

The need for a thorough investigation into the design of e-learning spaces is therefore apparent in order to understand and fill the knowledge gap through the proposed development of framework and toolkit design guide for future spaces and facilities.

This will encourage best practice with the incorporation of adaptive technology into learning spaces. Also it will address the issues of Inclusive design in the areas of equality and diversity; with respect to the Disability Discrimination Act.

2.4 FROM THE PROBLEMS TO THE SOLUTIONS

The summaries of problems identified from literature are:

- Lack of a specific outline for the designing of e-learning spaces (Smith, 2006a)
- The relationship of Design of e-learning spaces to Institution's Strategic vision(Smith, 2006a)
- And this to be clearly defined within design solution proffered (Smith 2006).

- View of learners to support the development of strategies for learning space design (JISC, 2006)
- A challenge still existed for HEIs that wished to manage the change and
- make investment decisions on new facilities, and gain access to the knowledge and experience of other HEIs (as benchmarks for their own progress and success) (Newton, 2005)
- Increased dependency of HEIs on technology supported learning systems without a sector wide approved structure for the delivery of spaces for the learning.(Newton, 2005)
- Anon (http://whitepapers.silicon.com 2005) observed that; *understanding of user defined requirement and interpretation into appropriate design solutions is the direction for the future; experimental vs. reality is part of what brings change; cost and funding has been over emphasised so also have design quality and type; departure from the traditional learning methods to embrace space integration & management (growth, change, process redefinition) is vital; speed of technology solutions vs. design is imbalanced, lopsided, uneven, too wide apart.*

The solution to these problems would generally be an expected and desired research outcome. But much more than this, it is thought that the documentation and adaptation of the solutions in such a way that they can be easily accessed and applied over and over again in a creative and innovative user-led way would be a much more enduring solution.

2.4.1 Possible Solutions for Future E-Learning Space Design

The JISC (2006) progressed on the JISC eSpaces Study, University of Birmingham (2005) www.ldu.bham.ac.uk/espaces and indicated that ‘current designs show:

- Increasing support for social, collaborative and blended models of learning
- More embedded use of audio-visual technologies
- Increasing hybridization of spaces

Flexibility in design, fittings and furniture to ensure sustainability

Figure 2.2 Robinson Rooms.’.

Figure 2.3 the ‘Interactive Kitchen’

Source JISC (2006) photo of University of Northumbria

JISC (2006) gave the example of the two pictures– figure 2.2 from FE and figure 2.3 from HE- shows how technology was usefully integrated into a learning space, without ‘dominating its design’.

According to Smith (2006a), the requirement for ‘flexibility often leads to large open plan designs’ Smith however cautioned that there were a few issues to consider in this regard. – That spaces currently having a restricted role such as labs/ catering demonstration theatres/medical training spaces were still required to have the potential of being ‘repurposed at a future date’. While ‘services placed under floor or audio visual or presentation technologies built into ceilings as in both pictures above, could allow for effective repurposing later on. ‘Technologies built into walls need careful thought however, as these will make subsequent resizing of spaces more difficult’.

Furthermore Gale (2006) explained that ‘flexible designs of furniture and fittings’ were also important for a space that is to be reorganized in order for its utilisation to be less restricted

JISC (2006) also mentioned that a lot of institutions had ordered ‘custom-built furniture’ to ‘support more collaborative styles of learning and to enable easier use of mobile computers in groups – Saltire Centre for example’. Smith (2006) asserted that the ‘21st century is going to see greater pressure exerted to achieve effective and efficient use of space in higher education institutions’ while stating that the ‘cost of high tech high profile and specialist spaces can be set to some extent against the increasing use of social areas, courtyards, circulation routes and learning centres/libraries as wireless-enabled learning zones, giving the institution opportunities to make its space utilisation more efficient and making learning from the learner's point of view more pervasive and seamless'.

Smith (2006a) mentioned that evidence from the case study suggested 'that audio visual technologies will play a more significant role in learning and teaching and will be increasingly embedded into teaching spaces in high tech spaces, or subject disciplines where sound and images or video links play an essential part'. That it was likely that 'these media will be more frequently used in all subject areas although probably using portable equipment for some while yet'. Smith also explained the example of the use of video and sound in 'Robinson Rooms' and in the 'Interactive Kitchen' of the University of Northumbria and the subsequent repurposing of captured outputs as learning objects on a VLE or on CD as what design combined with technology could deliver in future learning spaces.

Smith (2006a) also mentioned that 'in the future, we can expect to see…

- Spaces designed to provide simultaneous support for f2f and virtual learning
- Spaces developed to support innovative, experiential learning in f2f contexts
- A higher profile given to social areas supporting problem-solving and collaborative learning based around mobile and wireless and audio visual technologies
- Greater emphasis on developing learners' wider skills, especially creativity and adaptability'

Also in a presentation to HEDQF entitled 'delivering the future learning environments' Gale, and Williams (2007), stated that the solution would be:

- The move towards intelligent designs for intelligent buildings that would exhibit features such as IP and VOIP; Resilient Wireless Network; University-wide Access control; CCTV; Integrated Support systems for Learning systems management and Business systems management;
- Communication in Real time
- Visionaries and Talented people.

Figure 2.4 below is an illustration of an integrated system for an intelligent building by Gale and Williams (2007).

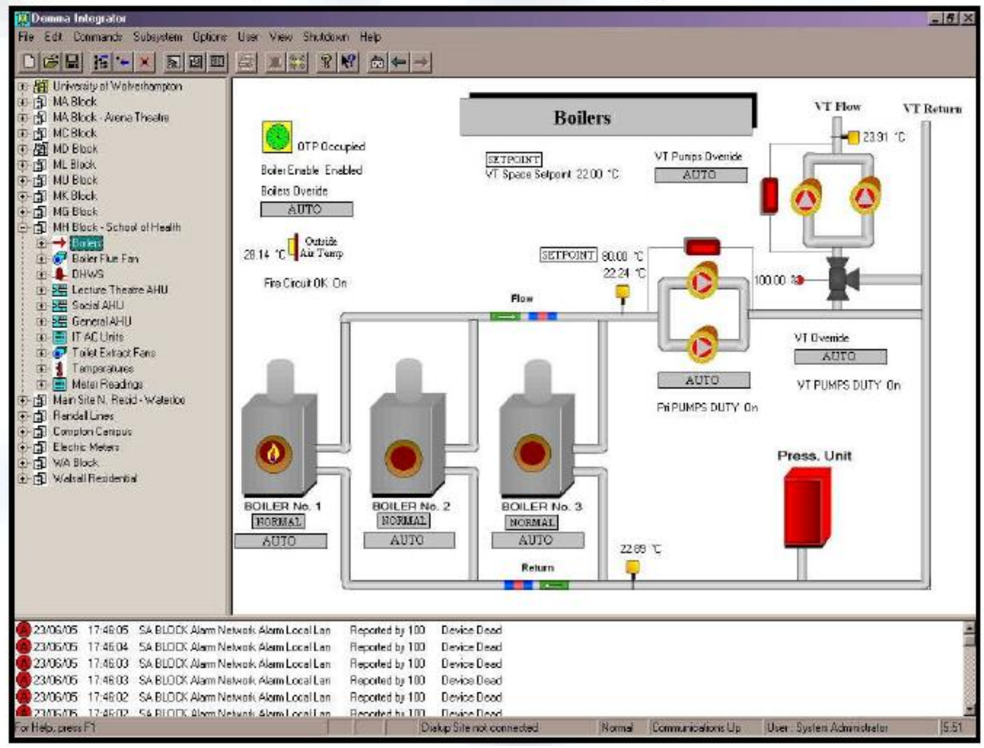


Figure 2.4 Integrated Systems-Intelligent Environments:

Source: Gale and William, 2005

2.5 SUBSTANTIATION OF RESEARCH AIM/OBJECTIVES

To substantiate the research aim/objectives, the views of relevant stakeholders were sought via focus group discussions.

2.5.1 Forums/ Focus Groups

The Forums served as current sources of information from the Stakeholders, Directors of Estates, Designers and Architect, teaching staff, facilities managers, CELT directors, Librarians and other Learning & Teaching Coordinators from HEIs. The forums were organized and held in the first year of the study. Details of the forums have been presented in Chapter six (See Appendix B, C and D for lists of participants and covering letters).

An understanding how to work towards achieving the research aim and objectives became clarified as examples of relevant projects such as the Think Tank in Birmingham, the University of Essex's Incubation lab, Saltire Centre etc. were discussed as well as the development of the broader research focus and background to the study. The research direction taken began to emerge. The next stage of data gathering which was to involve pilot survey and site based analysis of case studies was also influenced by the positive response obtained as a result of valuable input through the facilitation of meaningful discussions.

2.6 CHAPTER TWO SUMMARY

This chapter focused on a presentation of findings from literature reviewed on the key issues that affect e-learning space design, and the current thinking on justification of the research endeavor. Definition of design and an understanding of architectural design in the context of the research endeavor were briefly presented. Review of the relationship between e-learning space design vs. the strategic vision of HEI was presented. The identification of what user's want and require within e-learning spaces were flagged up. Previous studies indicated that some drivers for change, based on the users' social expectations and requirements were:- i) the need for motivational, ii) creative, iii) technology-rich learning spaces that would support collaborative, personalised as well as blended models of learning. Also a review of the SFC, (2005) report identified the diversity of student populations as another driver for change that could affect the design of e-learning spaces based on the assumption that users had diverse learning styles and patterns and would therefore have varied requirements that will suite the diverse user learning styles

Literature reviews also indicates that there was an increasing demand for 'personalised and flexible learning provision and a corresponding user requirement for the design of flexible and innovative learning spaces; which should be centralised, accessible, multipurpose in nature, in order to meet the demand for increase in space utilization. Other user requirements were the need for inclusivity. Researchers argued that there was a need for the university to provide support for a widened access and participation of learners.

JISC (2006) states that in responding to user requirement, future spaces and current designs showed an increasing support for social, collaborative and blended models of learning, more embedded use of audio-visual technologies, increasing hybridisation of spaces, flexibility in design, fittings and furniture to ensure sustainability while McCormack et al., (1997) in Neville and Heavin (2004) identified benefits of the creation of e-learning management systems. Some elements of good e-learning space design identified by JISC (2006) were; flexibility; future – proofed; boldness; creative, and supportive and enterprising.

Watson (2007) stated that educational buildings ought to encourage learning and meet the needs of users' (staff and students) Weiss (2006) stated that 'learning was being revolutionised' Gale and Williams (2007) stated that the solution would be the move towards intelligent designs for intelligent buildings.

Some benefits/outcomes as well as problems were identified and reviews were presented in this regard. According to JISC (2006), the motivation of learners is the ultimate end product. Hence achieving spaces that foster effective learning will require a holistic approach, including a dialogue with all key stakeholders.

The increase in use of ICT has resulted in new approaches to teaching and learning methods. It can therefore be inferred that this should in turn affect the design of teaching and learning environments as well.

CHAPTER THREE: - TOWARDS AN INNOVATIVE E-LEARNING SPACE DESIGN

3.0 INTRODUCTION

Chapter three presents an in-depth analysis of the subject area initially outlined in Chapter one i.e. in the form of reviews on the evolution of the learning space and a critical analysis of issues that affect the good design of e-learning spaces with respect to users' requirement, learning patterns, technological advances and related factors. Also a description of how the research identified best practice examples of good design in HEI construction from desk studies is discussed. This is in line with the first objective of the study. Also this chapter contains findings on the current thinking based on publications from industry practitioners on the design of e-learning spaces in HEI.

3.1 DEFINITION OF LEARNING; SPACE AND E-LEARNING SPACES

'Learning is acquiring new knowledge, behaviours, skills, values, preferences or understanding, and may involve synthesizing different types of information. The ability to learn is possessed by humans, animals and some machines' (Anon 1, 2010)

The action of receiving instruction or acquiring knowledge; a process which leads to the modification of behaviour or the acquisition of new abilities or responses, and which is additional to natural development by growth or maturation (Oxford English Dictionary, online 2010)

According to Jarvis, Holford and Griffin (2003: pg. 1), learning was as vital as breathing the most basic of human activities. Learning was defined as 'the process by which we become the human beings we are, internalize the external world and through which we construct our experiences of that world.' Jarvis et al (2003) observed that in recent years, learning had subtly taken over the centre position in the educational vocabulary. Thirteen major changes that education had undergone were discussed in their book. They are however listed hereunder. These changes were from:

- Childhood to adult to lifelong;
- The few to the many;
- Education and training to learning;
- Learning as a process to learning as an institutional phenomenon;
- teacher-centred to student-centred;

- liberal to vocational and human resource development;
- theoretical to practical;
- single discipline knowledge to multidisciplinary knowledge to integrated knowledge;
- knowledge as truth to knowledge as relative/ informative/ narrative/ discourse;
- rote learning to reflective learning;
- welfare provision(needs) to market demand (wants);
- classical curriculum to romantic curriculum to programme;
- Face-to-face to distance to e-learning.

The face-to-face to distance to e-learning changes is the most recent and relevant aspect to the study being undertaken, and as such a brief discussion on this is presented below.

According to Jarvis et al (2003), the development of the World Wide Web (www) along with electronic forms of communication has brought about the rapid growth of e-learning and virtual universities. (A recent example is the 'Hamdan Bin Mohammed e-University, the first of its kind in the United Arab Emirates, formally launched in February 2009. It is the successor of the e-TQM College which was initially inaugurated on September 30, 2002 by Sheikh Mohammed Bin Rashid Al Maktoum, Vice President, Prime Minister of the UAE and Ruler of Dubai. (www.HBMeU.ac.ue, 2011 January)

3.1.1 Types of Learning

According to Jarvis et al (2003: pg. 68-73) types of learning based on terminologies of authors reviewed were: 'Single loop and double loop learning' (Argyris and Schon, 1974:19); 'maintenance and innovative learning' (Botkin, et al (1979); 'critical learning' Brookfield, (1987:7-9); 'banking education and problem-posing education' Freire, (1972); 'non –reflective and reflective learning' Jarvis (1987; 1992); 'andragogic and pedagogic learning' Knowles (1980); 'Formative and transformative learning', 'Instrumental, communicative and emancipatory learning'(Mezirow, (1991: 72-89); 'Surface and Deep learning', Marton and Saljo (1984). Their book observed that all the above mentioned authors understood the potential for learning to change (Jarvis et al 2003: pg73)

Anon 2 (online, May 2010) also identified other different types of learning namely: 'Simple non-associative learning, Habituation, Sensitization, Associative learning, Operant conditioning, Classical conditioning , Imprinting, Observational learning, Play, Enculturation, Multimedia learning, E-learning and augmented learning, Rote learning, Informal learning, Formal learning, Non-formal learning, Non-formal learning and combined approaches, Tangential learning and Dialogic learning.

However, this study is concerned with the 'E-Learning', below are some definitions of the term 'e-learning'.

Definition of E-learning
'Electronic learning or e-learning is a general term used to refer to Internet-based networked computer-enhanced learning'. While 'a specific and always more diffused e-learning is mobile learning (m-Learning), it uses different mobile telecommunication equipment, such as cellular phones' (Anon 3, online May, 2010).

E-Learning was also defined as all forms of electronic supported learning and teaching, which are procedural in character and aim to effect the construction of knowledge with reference to individual experience, practice and knowledge of the learner. Information and communication systems, whether networked or not, serve as specific media to implement the learning process (Tavangarian D., Leypold M., Nölting K., Röser M., (2004).

Tavangarian et-al (2004) state that e-learning is essentially the computer and network enabled transfer of skills and knowledge. E-learning refers to using electronic applications and processes to learn. E-learning applications and processes include Web-based learning, computer-based learning, virtual classrooms and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, and CD-ROM. It can be self-paced or instructor led and includes media in the form of text, image, animation, streaming video and audio.

Acronyms like CBT (*Computer-Based Training*), IBT (*Internet-Based Training*) or WBT (*Web-Based Training*) have been used as synonyms to e-learning. Today one can still find these terms being used, along with variations of e-learning such as elearning, Elearning, and eLearning.

3.1.2 Learning Styles

The important idea of learning style ought to be investigated within all learning environments, whether they are technology-supported, or not. Syed-Khuzzan, Goulding and Alshawi (2009). The paper observed that there was 'no single way, to describe learning styles (LS), as several definitions were evident from previous literature (Syed-Khuzzan et al (2009; 314) cited examples such as Conner (2005) in (Syed-Khuzzan et al

(2009; 314) who defined learning styles as "….the ways you prefer to approach new information"; Kolb (1986) in Syed-Khuzzan et al (2009; 314) defined learning styles as "the unique learning method presented by the learner during the learning process and situation" while Dunn (1990) in (Syed-Khuzzan et al (2009; 314) described learning styles as "….the way each learner begins to concentrate, process and retain new and difficult information". Furthermore, Honey and Mumford (1992) defined learning styles as "…..a description of the attitudes and behaviour which determine an individual's preferred way of learning". Moreover, Felder and Silverman (1988) in Syed Khazzan (2009; 314) defined learning styles as "a person's characteristic strengths and preferences in the ways they take in and process information".

Sternberg (1997) explaining why aptitude tests, school grades, and classroom performance often failed to identify real abilities, listed various cognitive dimensions in his book 'Thinking Styles'. Some other models often used when researching learning styles includes the Myers Briggs Type Indicator (MBTI) and the DISC assessment.

One of the most common and widely-used is Leite, Svinicki and Shi (2009) categorizations of the various types of learning styles. Another is the Fleming (2001) VARK model which expanded upon earlier Neuro-linguistic programming (VARK) models. Hawk and Shah (2007): defined four types of learning styles namely:-

- Visual learners;
- Auditory learners;
- Reading/writing -preference learners; and
- Kinaesthetic learners or tactile learners (Ld. Pride, 2002)

Fleming (2001) claimed that visual learners had a preference for seeing (think in pictures; visual aids such as overhead slides, diagrams, hand-outs, etc.). While auditory learners best learnt through listening (lectures, discussions, tapes, etc.). On the other hand, tactile/kinaesthetic learners preferred to learn through experience such as—moving, touching, and doing (active exploration of the world; science projects; experiments, etc.). 'Its use in pedagogy allows teachers to prepare classes that address each of these areas.' Students can also use the model to identify their learning style and maximize their educational experience by focusing on what benefits them the most (Jackson, 2005; 2009).

‘The development of technology-enhanced learning is continually evolving, and, with the advent of digital age the learning industry has experienced a major paradigm shift over the last decade in e-learning’ (Venkatachary, 2002 in Syed-Khuzzan et al, 2009; 315)

It is assumed that the knowledge and appreciation of the learning styles of students and their preferences would assist teachers or education providers maximise the learning experience as they would be able to provide technology supported learning that enhanced these individual learner styles (Honey and Mumford, 1982, 1983, 2006); (Merriam et al, (2007). Hence this is also an important aspect with regards to technology choice and use within learning environments.

Smith and Kolb (1986) in Syed-Khuzzan et al (2009) were said to have argued that ‘learners may reject a learning environment that does not match their learning styles’. A view supported by Williams (2004) in Syed-Khuzzan et al (2009) who pointed out that ‘designing a learning environment that accommodates learners LS was essential for effective learning’.

Research shows that several educationists had made attempts to provide ‘ways in which learning style theory’ could take effect in the classroom (Smith and Kolb, (1986) in Syed-Khuzzan et al (2009). Two of such researchers are Dr Rita Dunn and Dr Kenneth Dunn who presented a background of how learners were affected by elements of the classroom and followed it with recommendations of how to accommodate students’ learning strengths. Dunn and Dunn (1978) wrote that “learners are affected by their: (1) immediate environment (sound, light, temperature, and design); (2) own emotionality (motivation, persistence, responsibility, and need for structure or flexibility); (3) sociological needs (self, pair, peers, team, adult, or varied); and (4) physical needs (perceptual strengths, intake, time, and mobility)” (Dunn and Dunn, 1978).

Dunn and Dunn(1978) analysed other research and made the claim that ‘not only can students identify their preferred learning styles, but that students also score higher on tests, have better attitudes, and are more efficient if they are taught in ways to which they can more easily relate.’ And that it was therefore, to the educator’s advantage to teach and test students in their preferred styles.

Although learning styles were expected to inevitably differ among students in the classroom, Dunn and Dunn (1978) state that ‘teachers should try to make changes in their classroom that will be beneficial to every learning style. Some of these changes include room redesign, the development of small-group techniques, and the development of Contract Activity Packages' (Dunn and Dunn, 1978). Redesigning the classroom involved locating dividers that can be used to arrange the room creatively (such as having different learning stations and instructional areas), clearing the floor area, and incorporating student thoughts and ideas into the design of the classroom (Dunn and Dunn, 1978).

Sprenger (2003) was another researcher who believed that learning styles should have an effect on the classroom. Sprenger based 'her recommendations for classroom learning on three premises: i) Teachers can be learners, and learners can be teachers. We are all both. ii) Everyone can learn under the right circumstances. iii) Learning is fun! Make it appealing' (Sprenger, 2003).

Sprenger (2003) detailed several ways in which teachers could teach in order that their students will remember. She categorized these teaching techniques in accordance to 'which learning style they fit—visual, auditory, or tactile/kinaesthetic'.

As such by the use of the different types of teaching techniques based on each of these categories, teachers were able to 'accommodate different learning styles'. They were also able to motivate students to learn in various ways (Sprenger, 2003). Furthermore in line with Kolb's idea 'that students who used all four approaches of his learning cycle learnt more effectively, students who were able to learn through a variety of ways were more effective learners'(Kolb, 1984)

3.1.3 Space

Space with respect to the physical environment is defined as '*the three-dimensional field in which objects and events occur and have relative position and direction, especially a portion of that field set apart in a given instance or for a particular purpose'* Ching (2007).

Space is defined as '*the physical extent or area; extent in two or three dimensions; extent or area sufficient for a purpose, action, etc.; room to contain or do something*.' Oxford English Dictionary (May, 2010).

Space is '*the boundless, three-dimensional extent in which objects and events occur and have relative position and direction'* (Britannica Online Encyclopaedia, 2010) Physical space is often conceived in three linear dimensions.

Space was defined by Lawson (2005) as ‘the basic tool of trade for the architect’

‘Architecture is the art of how to waste space’

Philip Johnson, *New York Times* (in Lawson, 2005).

Space and that which consequently encloses it are to a large extent more essential to us all in our daily living than simply ‘technical, aesthetic or even semiotic interpretation would suggest’ (Lawson, 2005). Furthermore Lawson (2005) states that it is space that unites as well as separates people therefore it was an important variable to the human relationship; adding that people need space often to tell them how to behave. Thus space ‘creates settings, which organize our lives, activities and relationships. Lawson (2005) explained that ‘in good architecture, space does this for us without our noticing’, and that it was his opinion therefore that it was not a possibility that Philip Johnson’s statement be considered as fact but rather as a joke. The book explored the concept of space as a language and how people can learn to read and work in this human language of space’

Terminologies which refer to types of space with respect to technology:

“Cyberspace” is a phase that is ‘currently used to describe the whole range of information resources available through computer networks’ Savin-Baden (2008).

“Digital spaces” those spaces in which communication and interaction are assisted, created or enhanced through digital media’ Savin-Baden (2008).

3.1.4 Reviews of Publications about Learning Space

In the past five years, the idea of space has increasingly become an area of interest particularly in higher education more particularly the focus has been on physical spaces (Savin-Baden, 2008 pg. 1-2). Recent examples include the study funded by the UK Higher Education Academy to carry out a literature review on ‘The design of learning spaces for the future, to facilitate pedagogical practices to support a mass higher education system, and greater student diversity’ (Temple et al., 2007 in Savin-Baden, 2008); other fairly recent study into physical learning spaces include- the key findings from a study funded by the Higher Education Funding Council of England, (HEFCE) ‘Planning and Designing Technology-rich Learning Spaces’(JISC, 2006) which was largely informed by the following reports:- Designing spaces for effective learning, JISC (2006); JISC eSpaces Report, University of Birmingham LDU (2005); SFC Spaces for learning, AMA Alexi

Marmot Associates (2006); SMG Impact of future changes on higher education, Institute of Education (2006); SMG Promoting space efficiency in building design, AMA Alexi Marmot Associates (2006). Another recent investigation into learning spaces was by Gale, (2006) 'flexible learning needs flexible buildings' Watson (2007)'Building the future of Learning' amongst others.

Majority of the studies mentioned above were 'commissioned research' (Denscombe, 2007) with the possibility of the reports being tailored for an audience that could 'be more concerned with receiving a report that is succinct, easy to digest and strong on practical outcomes' (Denscombe, 2007 pg. 317-318). Unlike this study which was produced for an 'academic qualification of a doctoral thesis' Therefore it was important for the researcher to note that the examiners and supervisors who are the audience in this case 'will be more focused on detail, rigour, precision, coherence and originality ' (Denscombe, 2007).

Therefore, while giving considerable thought to the concept of Denscombe, (2007) the concepts, research approach, philosophies and outcomes of these previous studies were examined and some of these were discussed to some extent in the previous introductory chapters as it was thought that the acknowledgement, understanding and critical reviews of these related studies would not only serve to inform this research, but that also the review of the studies would enable the researcher identify the knowledge gaps and similarities if any to the focus of the study being undertaken; in order to guide the researcher in selecting the most appropriate research method and approach as well as guide against likely avoidable errors and repetitions, in the presentation of this work because 'we can learn a great deal from what other researchers have done' (Bell, 2005 pg. 110-111). Bell (2005) however, cautioned that the researcher ought to be careful with the use of language, 'inferences may be drawn, results 'might indicate', but the researcher should bear in mind that in any dealings with human beings, 'proof' is hard to come by. Also Bell (2005), states that the researcher, 'should not be tempted to leave out any reports of research merely because they differ from their own findings.'

Furthermore, the evidence of the interest into learning spaces shown here suggests that there is now a growing concern for the physical spaces in higher education institutions as well as an increasing attempt by researchers to address the concerns and issues of the learning space within higher education institutions.

3.1.4.1 Learning Spaces in the Academic World

Savin-Baden (2008) explored the notion of learning spaces and the idea that there were different types of spaces generally in life and also within the academic world with respect to physical and as well as mental and metaphorical spaces. Savin-Baden (2008) writing on 'Learning Spaces' aimed to challenge the belief and 'expectations that ideas and thoughts really could be generated in cramped, overpopulated offices' swamped with e-mails and a stream of constant interruptions by people. Savin-Baden (2008) argued that there was a need for the recognition, promotion and re-creation of new and diverse opportunities for learning spaces to materialize in academic life. It can be assumed that the learning space being referred to by Savin-Baden (2008) in this context were non- physical.

Savin-Baden (2008: pg. 12), referring to non-physical spaces states that learning spaces can be 'created' spaces', or 'unexpected' learning spaces; i.e. spaces that just occur. The examples of such spaces were:-

- Bounded learning spaces: days away in which to think and reflect, alone or in a group.
- Formal learning spaces: courses and conferences
- Social learning spaces: where dialogue and debate can occur in informal and less bounded settings
- Silent learning spaces: away from sounds that get in the way of creativity, innovation and space to think
- Writing spaces: places not only to write but to consider one's stance and ideas
- Dialogic spaces: in which critical conversations can occur but also where the relationship between the oral and the written can be explored
- Reflective learning spaces: which reach beyond contemplation and reconsidering past thoughts they are spaces of meaning-making, and consciousness-raising
- Digital learning spaces: where explorations occur about new types of visuality, literacy, pedagogy, representations of knowledge, communication and embodiment.

The definition of learning spaces in the context of this study refers to physical spaces within Higher education institutions such as; general spaces, academic spaces, teaching and learning spaces, learning centres and social spaces as discussed below.

3.1.5 Review of Space Types within HEIs.

AMA (2006a) mentioned that there were different space types within an educational institution. 'Spaces include rooms for general and specialised teaching, for administration and social activities, and learning resource spaces'. These were:-

I. General teaching,

II. Vocational teaching,

III. Learning centre (which agrees with Smith, 2006a) and also

IV. Social spaces.

In addition to the above categories of spaces, **other space types identified** by AMA (2006a) were: - Group teaching/learning space, Simulated/special learning environments, Immersive environments, Peer-to-peer and social learning, Learning cluster, Individual spaces and External spaces.

Therefore for the purpose of establishing a general understanding of the four space types mentioned above and how they could be used and, the definition and space design requirements for these space types within a HEI, they are discussed here under based on the paper presented by AMA (2006a).

3.1.5.1. General Teaching Spaces

General teaching spaces usually consist of the largest spaces required within academic institutions. They consist of large lecture theatres, and rooms for different group sizes where different learning systems are used. This could be simultaneously or one after the other. The type of learning styles usually employed consist of: knowledge impartation through a tutor or instructor; 'group discussion'; 'collaborative learning' in small groups; individual learning within a technology aided environment and 'group presentations' (AMA, 2006a; JISC, 2006).

Figure. 3.1 shows some of the supporting technology and equipment which enables various learning styles. These may include the following:

•Fixed computer terminal

•Wireless broadband transmitter

•Ample power outlets on all walls and under floor

•Interactive whiteboards, projection screens and data projectors

•Display screens for pinning material

•Mobile lectern and desks

•Storage space for locking away equipment and furniture

•Folding/sliding acoustic wall partition to allow the room size to be reconfigured.

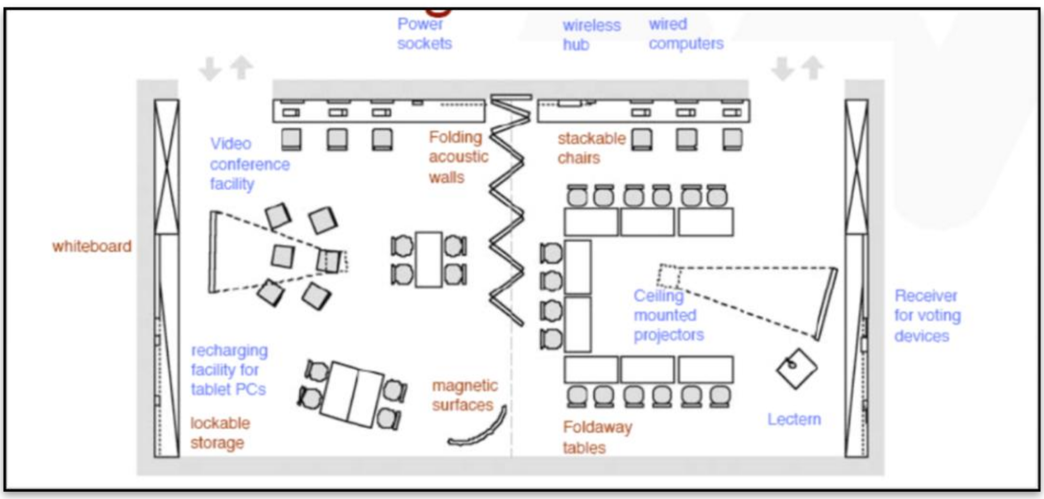


Figure 3.1a General Learning Spaces or Various Learning Styles with Supporting Technology: Source: AMA (2006a)

Figure 3.1a shows how various components of the space, the services and infrastructure, furniture and equipment could be arranged. AMA (2006a) states that within general teaching rooms the flexibility of the layout of the room, the equipment and style of teaching are important.

AMA (2006a) stated that the hard-wearing features were the size and shape of the room; the direction and size of entrances; the ventilation and lighting system; services infrastructure and fixed furniture. While replaceable features, were elements like the ‘cabling, light fittings, colour and finish of wall, floor and ceiling surfaces. The other features that change often and perhaps every hour, depending on the requirement of the teaching and learning style were the layout of the furniture, and equipment. The paper reiterated that in order to achieve maximum use of general teaching rooms, teachers and learners ought to be encouraged to clearly state all the various ways they would like to function. In order to enable the designers to try out how best their initial ideas fit in with to those requirements, and then try to come up with detailed design changes. The fixing of all details like the number and location of power outlets ought to be carefully checked before the design is approved. Figure 3.1b and 3.1c below shows general teaching spaces of Stafford Innovation Centre.

Figure 3.1b and 3.1c shows Customised Learning Spaces, Stanford University Innovative Centre.
Source: AMA (2006a)

Figures 3.1b and 3.1c depict learning spaces, that are information intensive spaces in which multiple data streams are used alongside each other. In these spaces, data may be required to be projected from any one of the various computers being used in the space as well as from fixed or mobile digital cameras. The spaces can also be utilized for more basic learning styles.

Figure 3.1d University of Wolverhampton Learning pod 'classroom of the future':
Figure 3.1e University of Strathclyde
Source: AMA (2006a)

These examples show rooms set up for group learning aided by more formal teaching. The example on the left shows tables for groups of six people with built in computer facilities.

Other parts of the room are set up for larger group gatherings, and for more informal, social learning. Roving tutors help students when needed. The example on the right is set up for more formal lecturing together with learning in small groups. The curved tables allow groups of four students to see each other while working together on material presented by the lecturer.

Figure 3.1f Peter F. Drucker Graduate Management Centre, Claremont University
Figure 3.1g James Wier Building, University of Strathclyde
Source: AMA (2006a)

The above pictures are examples of fixed furniture layouts within general teaching spaces which can be used for various learning styles.

Figure 3.1f is a case study space for teaching in a business school. The nature of the curved desks enables students to have a clear view of their colleagues when speaking, so that guided by the facilitator, everyone participates. The layout of the space and the built in equipment also works effectively for more formal lecture and demonstration modes.

Figure 3.1.g is a space designed to enable learners face the teacher, or turn around and study individually or collectively on the computers. The space was designed to support teaching sessions that require both learning styles, however the space can be used for either styles – either as a room for formal lecturing, or for computer-aided learning.

Figure 3.1h Technology Enabled Active Learning (TEAL) Engineering Classroom MIT:

Figure 3.1i University of Alabama SCALE –UP – Student Centred Activities for Large Enrolment Undergraduate Programs:

Source: AMA (2006a)

Figure 3.1h and figure 3.1i are from the USA they depict the integration of computer-based learning for individuals or small groups that also allows for group presentations called the TEAL and SCALE-UP programmes which were developed and have since been adopted by an increasing number of universities and colleges. TEAL stands for Technology Enabled Active Learning, and SCALE-UP for Student Centred Activities for Large Enrolment Undergraduate Programs. The paper states that there was some research evidence that learners in these programmes showed up for more sessions, had ‘lower drop-out rates, attained better grades, and retained their knowledge longer than those learners that had been taught in more conventional lecturing modes.

The paper also noted that the important features in rooms designed for this type of learning were:

•Furniture and computer arrangements for small groups

•Large screens on several walls for the presentation of shared information

•Cameras and data connectivity throughout the room. These arrangements do not need new buildings. Refurbishing of existing spaces will suffice as well as spaces in ‘purpose-designed new builds’.

3.1.5.2. Vocational Spaces

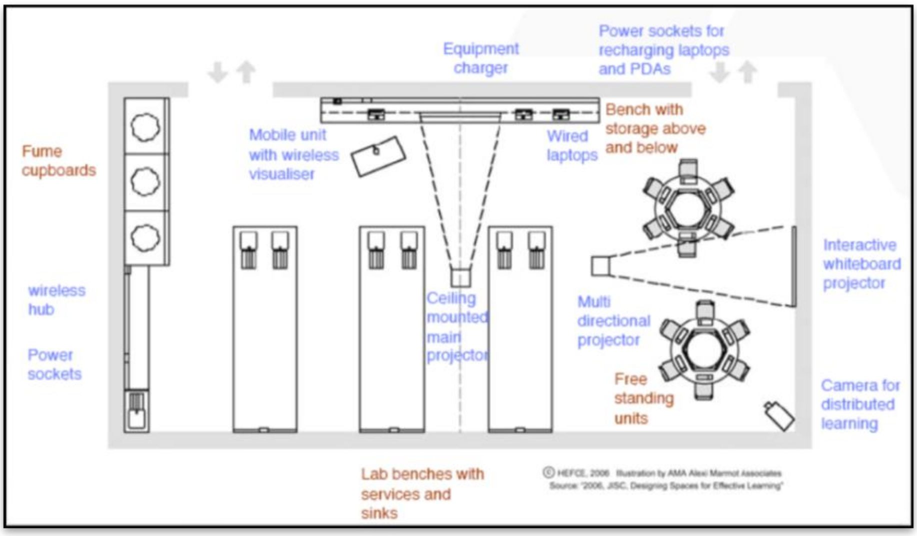


Figure 3.1j A Vocational Learning Lab:

Source: AMA (2006a)

The diagram showed more information about how the various equipment of a chemistry laboratory may be arranged. The paper explained that E-learning facilities together with experimental facilities were becoming more and more essential. Figure 3.1k below shows a vocational learning lab –that supports flexible learning

Figure 3.1k shows Alexander Fleming Building Imperial College London, while Fig 3.1l shows a vocational learning Lab University of Aberdeen

Source AMA (2006a)

The paper stated that the two pictures above are examples of how ‘different teaching presentation’ styles could be built-into the design of learning laboratories. The spaces require large screens for presentation in order for all to see. Sections where learners can write up experiments or research literature were created either within the same space or close by. In order to enable future adaptability of such spaces over time, it is a requirement for the services infrastructure to be designed for reconfiguration. AMA (2006a) explained that for example, ‘chemistry laboratories should be able to have more services added if needed, or to be readily convertible into laboratories for other disciplines, if possible.’

Figure 3.1m Shows Vocational teaching spaces for- Health skill

Figure 3.1m shows Vocational spaces for – School of Health, University of Wolverhampton
Source: AMA (2006a)

The paper explained that ‘health and social care learning required some learning laboratories configured as simulated hospital environments, primary care facilities or private homes.’ The pictures above are an example of a ‘simulated hospital ward and a physiotherapy space’. AMA (2006a) noted that the design of simulated spaces of this nature requires the following:

•Attention to the space needs of a group of learners, balanced with the need to simulate a real environment such as a small GP examination room.

•Incorporation of special services and equipment such as hospital gases (either real or simulated).

•Aiming for flexibility of use so that highly specialised rooms that were needed only infrequently can be used for more than one purpose.

• Mobile furniture that can be pushed to one side for a new setup or to free space for general teaching can help achieve better space utilisation, as can the provision of data for computers and presentation.

•Large storage spaces nearby are needed for equipment and furniture to allow rooms to be reconfigured. Goods lifts for large equipment may also be required.

3.1.5.3. Special Teaching Spaces

Figure 3.1n and Figure 3.1o are examples of special teaching spaces- immersive environments

Figure 3.1n and Figure 3.1o Immersive Environment in the Reality Centre:

Source: AMA (2006a)

The paper explained that figure 3.1n and figure 3.1o were examples of ‘environments applicable to advanced data scrutiny and three dimensional representations which may be required for some ‘IT courses, geophysics and scientific disciplines.’

3.1.5.4. Learning Centres

AMA (2006a) stated that Learning Centres, including libraries, were a necessary part of most educational institutions. Learning centres that offer students access to multiple media, and spaces for individualised or group work, were the hob of several high-quality institutions.

The location of a learning centre near to the centre of the social spaces, maybe adjacent to or accessible to the major library, was considered ideal. The sketch below is an example of how several different ways of supporting learning could be organised and arranged. The paper also explained that 'computer terminals for either short term drop-in use, or longer stay, were provided, and information in the form of published journals or other media were also available to use. A plasma screen may display current news. Headphones enabled people to listen to videos or music without disturbing others. Places for group or individual learning, in relaxed or more formal furniture settings were incorporated.' And it also noted that an outdoor learning space equipped with wireless data was desirable. Figure 3.1q shows a sketch of a Learning Centre.

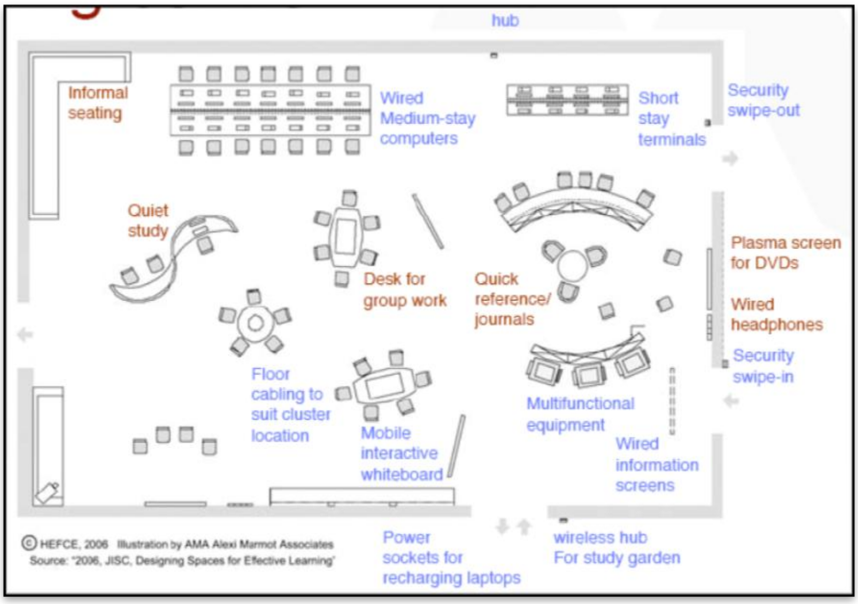


Figure 3.1p Learning Centre Sketch
Source: AMA (2006a)

The paper explained that the various areas within the learning centre enabled a number of learning styles while using different media, but noted that the power and data infrastructure were to be carefully planned to enable future reconfiguration.

Figure 3.1q Learning Centre, Saltire Centre of Glasgow Caledonian University
Source: AMA (2006a)

The Paper discussed another example of a Learning Centre; Saltire Centre in Glasgow Caledonian University, which integrated social activity and more structured learning. The paper explained that an after the success of an earlier experiment with the 'Learning Café' the university became convinced that a larger facility for integrated learning was required.

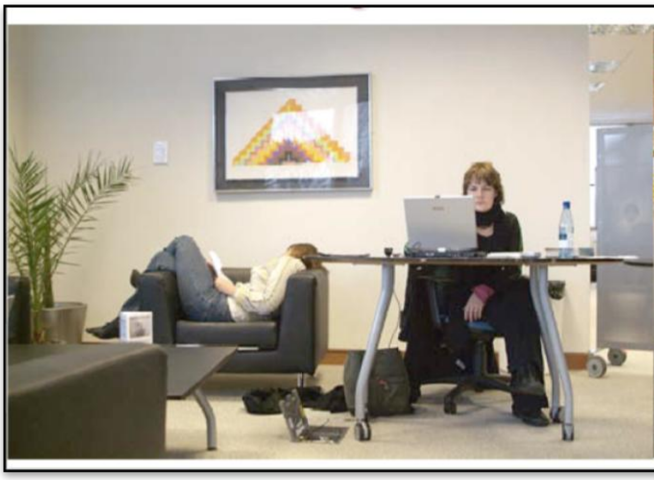


Figure 3.1r University of Warwick Learning Grid Figure 3.1s University of Lincoln
Source: AMA (2006a)

The above pictures are examples of learning centres that allow relaxed ways of learning, with sufficient access to online information and indexes.

Figure 3.1t and Figure 3.1u show Learning Centres with individual study spaces provided.

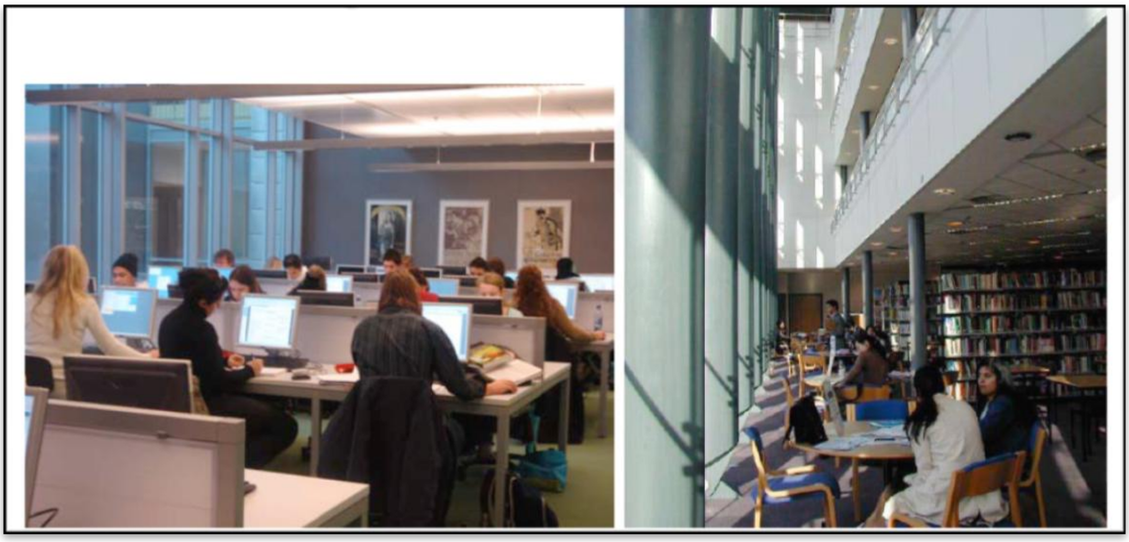


Figure 3.1t Norwegian Business School, Oslo

Figure 3.1u University of Wolverhampton Learning Centre

Source: AMA (2006a)

The paper observed that ‘within more traditional ‘library’ environments, spaces for individual and group learning, with or without computers, needed to be integrated. While consideration for the high quality of design by the use of natural and artificial lighting; consideration for materials and details like the ergonomic design of furniture, wall colours and well placed artworks, aided the learning experience. Users perceived such spaces to be desirable places in which to study.

3.1.5.5. Social Spaces

The paper noted that Social learning spaces helped to:-

- Increase student motivation and desire to learn
- Help to forge a ‘community of learners’
- Offer meals and refreshments, meeting opportunities, information access
- Open-access, informal working environments
- Wired and wireless connectivity

AMA (2006a) also mentioned that social spaces could be ‘used to help create a positive attitude towards learning’ and that within the social learning space scenario, the power of a community of learners engaged in self-development could be acknowledged.’

The paper asserted that social spaces were increasingly becoming ‘integrated into natural travel routes within an educational environment, and used for multiple purposes’. Fixed computers were added close by, while wireless connectivity enabled learners to study with their laptop in a similar way as ‘commercial internet cafés.’

Furthermore it stated that ‘in many new buildings, the social spaces formed the heart of the design. Catering, open-access learning and opportunities for staging big events such as major lectures or charitable fundraising activities can be housed for example within an entrance atrium. Smaller social spaces were usually placed in alcoves along main circulation routes or learning ’streets’.

Figure 3.1v and Figure 3.1w Show examples of social learning spaces

Figure 3.1v, Sheffield Hallam University   Figure 3.1w, North Hertfordshire College

Source AMA (2006a)

The examples show ‘catering tables and computer terminals located in places such as entrance areas, atria and adjacent to main corridors, for ease of meeting people, and ready access to information. Utilising connector spaces for these purposes aids efficient use of space resources while at the same time encouraging ubiquitous learning

3.1.5.6 Factors that Affect Space Use:

According to AMA (2006a) some factors that affect the effective use of space within an e-learning environment. These are listed hereunder:-

Decision making about the space use

- Prepare a clear brief of all requirements

- Involve users in defining the requirements: staff, students
- Explore new teaching styles and learning technologies that may be used in the new space
- Investigate and test options including refurbishment of existing rooms, building an extension or a new building
- Write an outline business case for funding approval
- Select a good design team
- Consult on designs as they evolve (AMA, 2006a)

AMA (2006a) also stated that excellent design evolved from a clear, rational process which usually began with a 'high level clear vision' set out by Executive managers or academic staff. Furthermore, a clear brief of requirements was then needed to be set out and 'agreed through a process of consultation.' The paper stated that in almost all 'educational bodies, learners and staff - administrative, academic and operational – ought to be consulted to help clarify requirements and place priorities.' The preferred modes of learning and teaching needed to be discussed thoroughly. But it stated that whatever they were now, they were probably going to change in future so the bounds of flexibility ought to be established.

It explained that a central team of people should agree on the main requirements, and may require professional help; that the different ways for delivering the requirements ought to be explored and usually includes the decision of whether a new-build was important, or whether an older building could be renovated or extended. And also 'feasibility studies by skilled architects and quantity surveyors' may be recommended at that stage. The paper also stated that the ability to match funding to expectations was not an easy task and as such a properly 'argued business case' needed to be drafted which clearly states why change was needed, what alternatives had been explored and the probable cost, duration and 'risks for the preferred course of action.' It also explained that approval by the board or governing body was necessary and that selection of a reliable design team by some type of 'competitive process helps create a successful project outcome.' They should be experienced, informed, and compatible with the institution's protocols for reporting and consultation.

3.1.5.7 Key points to note for Space 'Planning & Management':-

Another aspect that enables successful space delivery was said to be Space 'Planning & Management' with respect to this, the paper suggested that the following key points were essential:

- Consider space efficiency to use space resources well
- Maximize the amount of centrally allocated learning space
- Plan for multiple functionality in most rooms
- Select design teams who understand space efficiency and management
- Involve the IT/AV team in all design projects
- Flexibility to meet evolving future needs is essential
- Power and data installations should allow easy alteration
- Use good IT systems for timetabling space, managing room set-up and IT/AV requirements

The paper reiterated that there was pressure to use resources wisely which implied that space management of all buildings - new and old – ought to be taken seriously. It stated also that 'in some institutions, special teams are established for just that purpose within estate corporate planning departments. Effective use of space can be aided by seeking to have most rooms centrally owned and allocated rather than being within the remit of any one department. Special vocational teaching rooms can sometimes be converted into general rooms on the central bookings list, by intelligent design'.

The selection of design teams ought to state that space efficiency would be a criterion for their selection, along with the need to report frequently on space efficiency in the output brief.

AMA (2006a) stated also that, the teams responsible for IT and AV installations and operations ought to be involved in establishing the brief and commenting on all proposals. E-learning relied on 'their strategic knowledge in advising on, and selecting all technology, and operating it on a day by day basis. Flexibility to change and adapt to future learning technologies is also needed through the intelligent design and specification of infrastructure routes and capacities'.

Tools for space management, timetabling and inventory management were constantly evolving. The best tools that were not expensive ought to be investigated for 'entry systems, room bookings, furniture and AV setup, temperature and energy monitoring, operation of IT and AV networks, space charging and inventory control of furniture and equipment. Web based system, remote sensors and the use of RFIDs should be considered'.

3.1.5.8 Key points for furniture and room layout:-

- Select the right furniture for each space

  Selection criteria:
- ergonomics and comfort
- footprint and modularity
- mobility, storage and stackability
- durability, cleanability and maintenance
- capital and lifetime costs
- sustainable materials and disposal
- Follow good procurement practice
- Communicate desired layout in bookings and to setup staff

The paper reiterated that learning rooms often had numerous possibilities for the layout of furniture and equipment suitable for different teaching and learning modes. That therefore **the design team needed to be completely familiar with the requirements of users in order to choose the right furniture for the job**.

It was suggested that several different conditions should be used to choose the right products, as mentioned above. Choices ought to be taken seriously. A compilation of products selected by the design team ought to be tested out in a 'beauty parade' by installing examples and having users vote on the best.

Furthermore it suggested that the procurement department must be consulted. 'Preferred suppliers may already have been selected in a framework agreement. If their products are not suitable, they may be able to buy in products from other manufacturers. Framework agreement already in place from OGC and The Buying Agency may be utilised.' In some cases it noted that a full OJEU procurement route may need to be followed for publicly funded educational bodies.

The paper further states that once new spaces have been devised and built, the variety of setups should be available for teachers to select through the booking system. If operations and AV staff normally arrange rooms before each session, the needs should be communicated to them clearly, and the actual set up should be monitored. (AMA, 2006a)

3.1.5.9 Some keys to Design Excellence:-

1. Provide strong leadership
2. Integrate strategies for development, learning, IT, estates
3. Appoint the right people internally and externally
4. Learn from your own and other successful learning spaces
5. Consult with users
6. Develop and communicate a clear brief
7. Make a realistic financial commitment
8. Plan flexible space for future learning modes
9. Manage the space well - bookings, setup, maintenance

The list above was a summary of good practice for the educational sector they proposed.

Some of the findings from **the AMA Space-ware Survey (2006b)** are presented below:

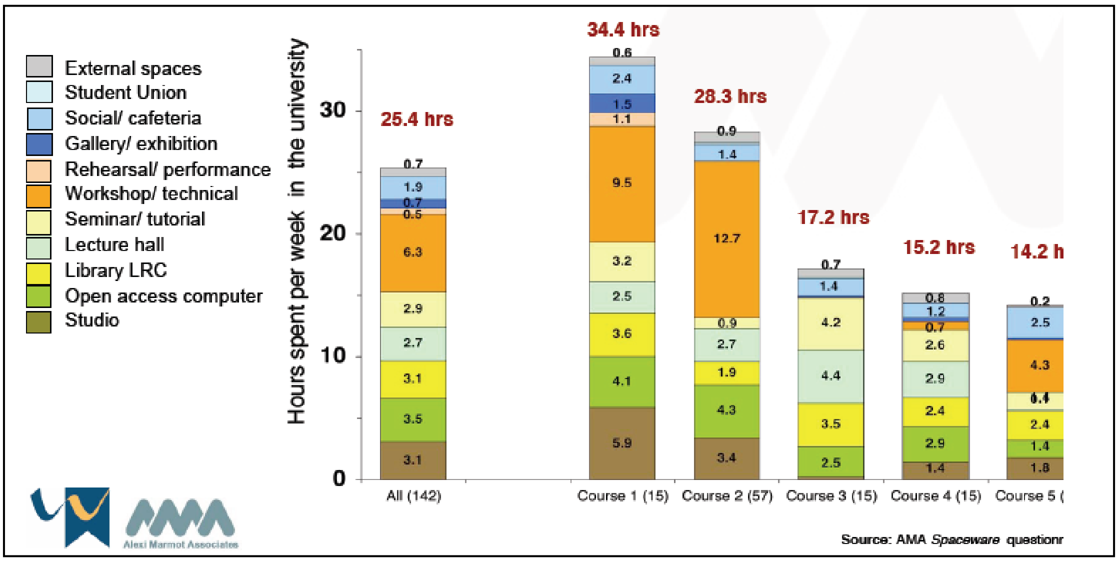


Figure 3.2 Time Students Spend in different University Spaces

Source: AMA (2006b)

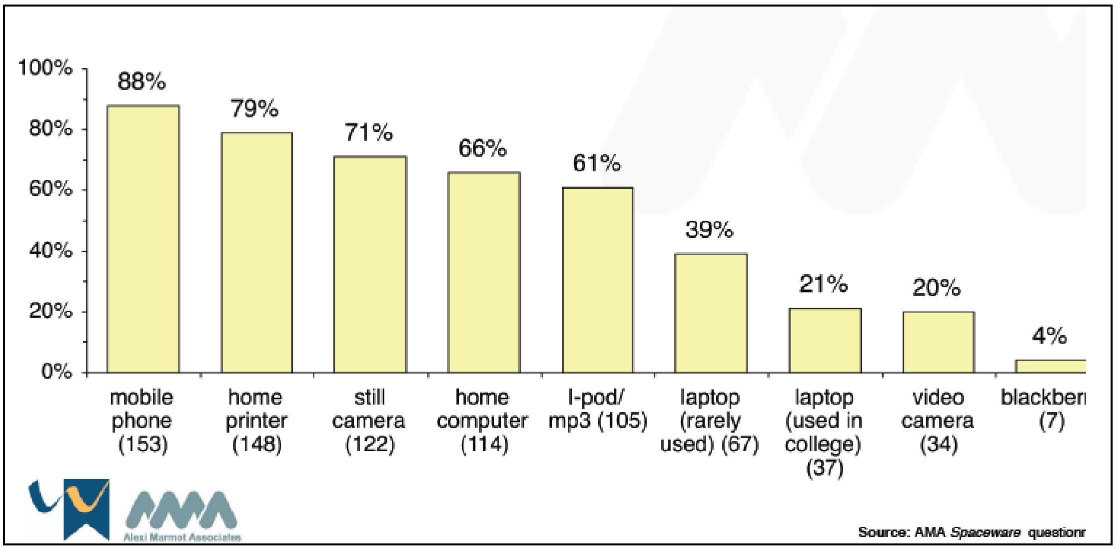


Figure 3.3 Type of Equipment Students' Use for Courses

Source: AMA (2006b)

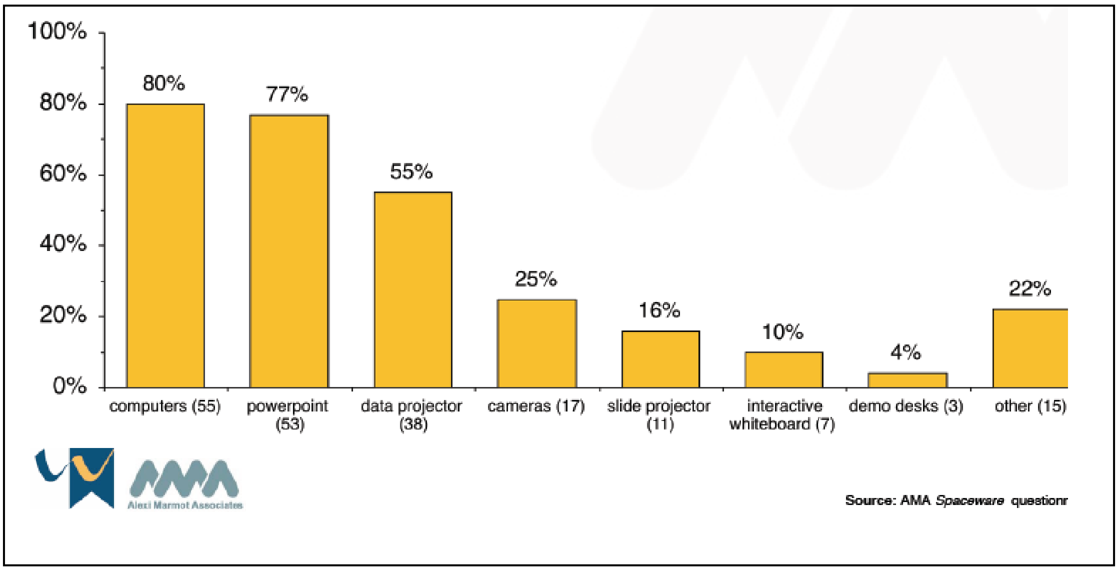


Figure 3.4 Type of Technology Staff use for Teaching:

Source: AMA (2006b)

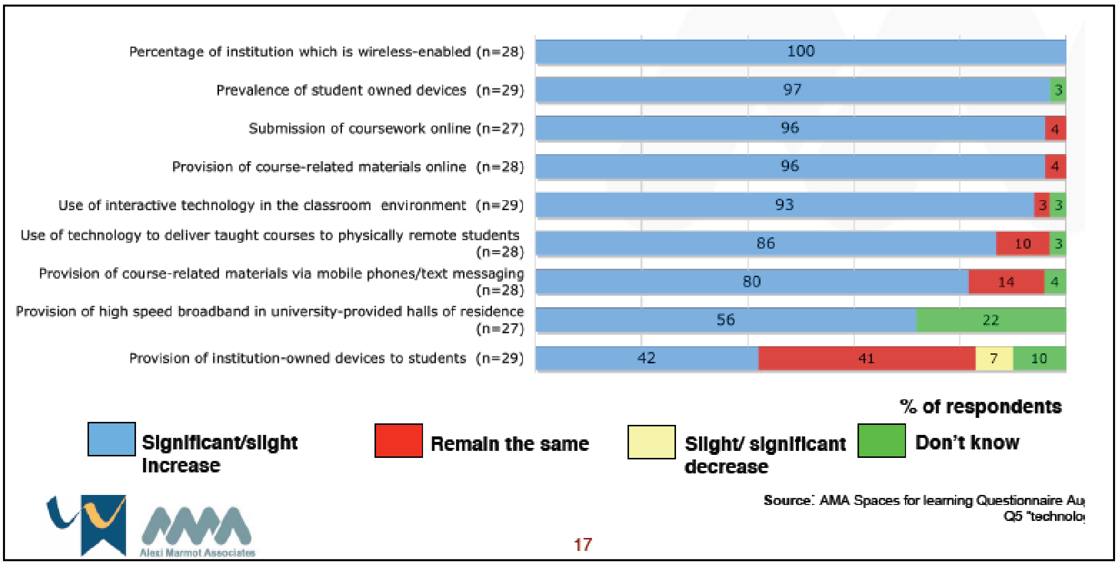


Figure 3.5 shows the trends in learning and teaching technology

Source: AMA (2006b)

3.2 THE EVOLUTION OF THE LEARNING SPACE

The origin of learning spaces can be traced back to the pre-literate era and Palaeolithic age where man sought to control and explain his experiences within his world. Historical accounts states that it was about 2,400 years ago that Plato a renowned philosopher began the intentional quest for knowledge; that his writings have provided man with the initial method of systematic analysis to enable man comprehend his world. (Pierce, 2001). An in depth review of this is presented in Chapter four.

3.2.1 A Critical Analysis of Issues That Affect the Good Design of E-Learning Spaces

This section presents a critical analysis of issues that affect good space design from the review of publications and literature on the subject area. (JISC space publications & AMA designing for excellence)

3.2.2 The Design of Learning Spaces

AMA (2006b) states that "the design of learning spaces within educational institutions is affected strongly by the role of the organisation, and the external context." The report explained that Political pressure related to the provision of excellent education to additional people has speed up the demand for student places over the long term. It was observed that the increase of International students coming into the UK even though growth trends was considerably reduced albeit temporarily as a result of the "introduction of higher student fees, the longer term picture was sustained growth." Staffs were being tasked with teaching greater number of students on regular bases with fewer facilities.

Therefore it was asserted that "E-learning tools and systems" could assist with the delivery of improved learning to additional people. The assertion that "Intelligent, efficient design of space also makes an important contribution." As well as "an efficient property portfolio and space design aids the financial accounts." It however argued that the "contribution of property to effective learning, to helping to attract and retain the right students and staff, was even more important." Adding that significant messages about the institution were communicated through the form, buildings and spaces within the campus. It then concluded that an affirmative expression of the highest institutional evaluations mattered to the students and staff. As such HEIs were expected to achieve goals of accessibility and sustainability for example. Accessibility was defined as "encouraging all people, even reluctant learners, to consider education, and ensuring no physical barriers hindered student learning". Building design should stop any disability such as physical, auditory visual, from preventing access to most spaces. Sustainability is well served through specifying energy efficient, non-polluting products and servicing systems.

3.2.3 Review of Space Design within HEI

The following sections were reviews from previous research carried out on the measurement of design quality within an E-learning focused building by the use of the design Quality Indicator Tool (DQI). They have been included herein as it was considered that these were relevant reviews on the issues that affect good e-learning space design.

3.2.3.1. Critical Analysis of Space Design, Form & Quality

The JISC eSpaces Study of the influence of technology on learning space design by Birmingham University identified two main drivers – pedagogic and operational. The report states that operational drivers could be specifically relevant for vocational study spaces, as "the need to refurbish ageing or scattered estate, and the impact of changes in the economy and in demand for types of courses have frequently prompted institutions to reassess their provision". It stated that the Pedagogic drivers were also relevant. It mentioned that "Laboratory or workshop-based learning and outreach classes" could habitually be an unpleasant experience because it is conducted in old fashioned environments often away from the main campus. The report suggested that this situation ought not to reoccur in the design of new eLearning spaces as maximum consideration should be given to space, form and quality of the environment (AMA, (2006a) in JISC, 2006).

According to Prensky (2001) in Watson (2006 pg. 165) “Today’s students are no longer the people our educational system was designed to teach” and the statement by Land, and Jarman, ‘Breakpoint and Beyond’ in Watson (2006) p.166) reiterated the need for futuristic thinking.

Watson, (2006: p.166) stated that “…the reference point is the future, not the past. We don’t need to fall back on the past for our decisions. Choices are based on alignment with our purpose and our vision for a different world” thereby underpinning the importance of space design quality as well “Reform the environment; Stop trying to reform the people. They will reform themselves if the environment is right” (Buckminster Fuller)

Smith, (2006a) in JISC Designing Spaces for effective Learning stated that spaces could be also classified into three types within HEI’s; a) general teaching, b) vocational and c) learning centers. It was assumed that the 21st century would experience greater demands for achieving effective and efficient space design and use in higher education institutions (Adejumo, 2006 p. 22).

3.2.3.2. Space Design Management

The e-learning space design and management should enable persistent interaction among learners, trainers, operators, and educators so that it enhances acquisition of the knowledge requirements of diverse learners as well in specific and varied environments (Wolf, 2002).

3.2.3.3. Space Management within HEIs in the UK

The UK Higher Education Space Management Group (SMG) commissioned a report prepared by AMA Alexi Marmot Associates entitled “Promoting space efficiency in building design” in march, 2006 with the aims of identifying “which aspects of building design contributed most to optimum space efficiency”, and “to promote good practice for establishing space efficiency within higher education institutions during project execution” The report (SMG, 2006) was compiled from desk survey, experience of space efficiency practice in other sectors and findings from fifteen case studies of recent refurbishment, expansion, upgrading or new builds in higher education institutions.

3.2.3.4. Achieving Optimal Space Efficiency through Building Design

Ten key points which the report summarized as vital for achieving optimal space efficiency through building design are listed below.

- Maximize the built space on the footprint of new buildings and by modest additions and extensions in existing buildings
- Match new uses to existing built form in refurbishment projects
- Provide a high ratio of useable are to gross built area
- Provide versatile space, furniture and fittings that can be used for different activities
- Specify design features that allow different activities at different times
- Optimize space standards for effective work
- Create versatile office and research space, with appropriate open plan areas, supplemented by meeting and quiet spaces
- Optimize furniture sizes for effective work.
- Provide for wireless data access to enable maximum use of common spaces.

3.2.3.5. Benefits of Adopting E-learning Space Efficiency Methods

Furthermore the report summarized ten points “of good practice with introduction of space efficiency listed below.

- Appoint a ‘champion’ for space management and cost in use.
- Systematically collect and update space and cost information
- Agree targets and monitor their attainment
- Collect standardized utilization data, including office space utilization.
- Collect and apply detailed cost information
- Incorporate space efficiency concepts into the estate strategy
- Incorporate requirements for space efficiency into project briefs, feasibility studies, option appraisals and design reviews
- Develop and maintain a clear decision and communication structure for building projects, including user groups
- Promote the benefits of versatile spaces and right furniture
- Include space efficiency information in post occupancy evaluations.

The report noted that there were ongoing reviews and debates in relation to the extent to which buildings and their design may affect the reputation and success of an HEI, through the retention of student and staff. The report also recognized that design quality could be important in that respect but acknowledged that it was not an area it had covered, adding that the effect of building design had been covered in more detail by a recent report from the CABE

3.2.3.6. Student Trends and Academic Change

The SMG (2006) report with respect to student trends and academic change noted that

- Participation in higher education had been rising overall, with greater increase in part –time learners than full-time at the undergraduate level.(Universities UK 2004)
- That further increases in student figures were to be expected. The government target of 50% of 18-30 year-olds attending HEIs meant 300,000 extra students by 2010 (Davis Langdon Everest 2002 in SMG, 2006)
- There was a larger span in the type of students, and new courses were increasing in importance (for instance non-medical health professions, media and creative arts), added to the new approaches (pedagogies) to teaching and learning, the use of Information Technology IT and e-learning.(JM Consulting ‘s report to HEFCE 2002/31)

3.2.3.7. Impact on the Design of Space

The SMG (2006) report on the issue of impact on the design of space noted that changes in HE were “being accompanied by and in some cases causing considerable modifications in buildings in the HEI estate” it noted that “space efficiency was improving across the sector, with less space on average per student, institutions offering longer teaching hours and more pooled space:

This the report reiterated resulted in the following

- A minute reduction in the non-residential net internal area(NIA) per student full-time equivalent (FTE) between 1999-2000 and 2001-2002 (JM Consulting ‘s report to HEFCE 2002/31)
- In 2004, 50% of HEIs were operating less than 8.4m2 NIA per FTE now compared to 42% in 2006(EMS Annual report 2003)
- HEI estates departments were executing many projects specifically to achieve site and building consolidation.

3.2.3.8. Space Requirement, Space Efficiency vs. Space Effectiveness

While the report reiterated the need for a balance between space efficiency and effectiveness, it mentioned that new modes of teaching and learning for example often needed a wider space per student within teaching areas in addition to the provision of new student-centered learning, environments within the HEI. SMG (2006) report noted that the management of spaces and its coordination with the wider aims of each HEI was very vital and had been reviewed by other SMG projects.

The report suggested that future space requirements will be determined by student figures and preferences outside the control of HEIs. But expressed the opinion that "institutions could wield their influence over the impact on space demand that may arise from changes in academic courses or pedagogic approaches from management factors"

It concluded that changes in the external and internal environment would result in the remodeling and redevelopment of all types of HEIs estates be they teaching-led, liberal arts, or research-led to enable them meet new requirements for larger space that will accommodate unstructured/ad hoc self-directed and collaborative learning amongst students.

The report stated that three factors were considered as vital to the space efficiency of any building. These are

- The quantity of space calculated in relation to floor area though volume could also be relevant
- Number of users, potential and actual
- Duration of time the space was used.

SMG (2006) stated that a building that had been designed for space efficiency should provide the following

a) The minimum necessary space for the desired functions to be properly accommodated, with minimum 'waste' between net area and gross internal area (NIA: GIA), expressed often as the ratio net: gross) or between net usable area and net internal area (NUA: NIA) expressed as percentages.

b) The minimum space necessary for effective learning and research per FTE student (space per student FTE) or staff (space per staff member, or laboratory worker, FTE)

c) A high level of space utilization because the space is used for the maximum possible amount of time (Education and Learning Wales (2002) HEFCW) particularly applied to utilization of teaching space, though it can also be applied to office space use. (Usually expressed as a percentage of hours that workspaces are used daily i.e. 10hr working day 8am-6pm) this is compared to a benchmark (typically 50hours per week during term time) multiplied by the percentage of occupied seats

3.3 HOW TO IDENTIFY GOOD EXAMPLES OF E-LEARNING SPACE DESIGN

From the above reviews and the earlier review done in the preceding chapter, the study has been able to acquire guidance on how to identify best practice examples of good design in HEI construction. From desk studies, Forum, literature review, interviews, site based analysis, observation, recording, questionnaire survey

The main elements of a good design are basically what AMA (2006a) and Watson (2006) had stated.

According to AMA (2006a) Essential design qualities for an e-learning space were

• Scale, accessibility, views - the boring basics

• Infrastructure - power, data

• Furniture

• Flexibility

• Sustainability

• Density, utilisation, space and dimensions for the learning style

• Air, heat, light and facilities management

Watson (2006) pinioned that an educational building was an "expensive long term resource" where space design is needed to exhibit some key attributes such as:

- Flexibility in order "to accommodate both current and evolving pedagogies",
- Future – proofed in order "to enable space to be re- allocated and re-configured",
- Bold in order "to look beyond tried and tested technologies and pedagogies",
- Creative in order "to energise and inspire learners and tutors",

- Supportive in order “to develop the potential of all learners” and
- Enterprising in order “to make each space capable of supporting different purposes.”

According to Watson (2006) well designed spaces have a motivational effect, and involving learners in the aspects of the design is considered to be important.

According to CABE (2011) the following were listed as ways for identifying the “features of good design understanding what makes a good building design”.

I. What is good building design:

- a building that is fit for purpose and built to last
- a building that that is in the right place and that responds to its surroundings
- a building that everyone can use with equal ease and dignity
- a building that responds to environmental imperatives and minimises its carbon footprint
- a design that creates spaces and places around buildings that people will enjoy and be proud of
- buildings that generate a sense of belonging.

II. What other features make good design:

A good building has certain other qualities. It will be:

- visually well organised – shown by things like symmetry or asymmetry, proportion and balance
- clearly organised for the user - for both the site and the building
- suitably prominent – sometimes buildings should be prominent, sometimes discreet
- straightforward – the design should not disguise the real way it is built
- well matched – the structure and detail of a building should fit together as part of a clear approach to style and the building function
- flexible and adaptable – a building able, within reason, to cope with changes in the needs of the user and potential technological developments
- clear what its function and role is – by its relation to public space, and features that can be seen from outside
- well integrated in its structure – these aspects should be part of the overall design from the earliest opportunity
- careful with how light and sun fall on the building - and with views from it and of it

- use well-chosen materials and robust detailing – considering how well finishes wear and last and whether the materials used help towards a sustainable approach.

3.4 TOWARDS AN EFFECTIVE E-LEARNING SPACE DESIGN

3.4.1 Key Points for Effective Design

According to JISC (2006a) the key messages and thinking to uphold in order to move towards achieving effective e-learning space design with HEI are as follows:

- "Understanding what makes an effective design is important. The best are likely to assist all within the institution to work more productively and to produce learners who are confident, adaptable, and inspired to learn."

- There can be no one blueprint for the design of learning and teaching spaces but

- "What is important is that designs of physical spaces are linked to the institution's strategic vision for teaching and learning and that this is articulated in every detail of the design, and shared with all stakeholders, including learners."

- "Embedding technology into learning and teaching spaces is likely to be an evolutionary process rather than a revolutionary one."

- "Start by establishing your pedagogic aims, then review the design and the technological infrastructure in the whole institution."

- "To resolve what is the best way forward, effective dialogues are needed to establish what will be required from the spaces, what changes in pedagogic approach are desirable and why

- "The design of our learning spaces should become a physical representation of the institution's vision and strategy for learning – responsive, inclusive, and supportive of attainment by all."

- "Review space management procedures to ensure effective reporting and decision-making structure. A cross-institutional management group comprising directors of finance, estates and student support services, academic heads and a senior member of IT Services will be needed."

3.5 AN INNOVATIVE APPROACH TO E-LEARNING SPACE DESIGN IN HEI

3.5.1 What is Innovation in Design?

The word innovation can be defined as that which is novel, advanced an improvement on an existing scheme or one which exhibits originality. Innovation in design should reflect these aspects. Furthermore, CABE (2011) states that it is expected that an innovative design solution should be inclusive as it was imperative "because we are designing and building for a society which is naturally diverse." The assertion was that *"Good design can promote health and wellbeing, safety in public spaces and ameliorate the impact of poverty and deprivation. It can also contribute to strengthening communities by encouraging voluntary mixing and mingling within neighbourhoods and between groups."*

CABE (2011) suggested that there were two ways of applying inclusion in design so as to achieve innovative and workable outcomes in practice: these were consideration for:

- *Physical impact - the location and design of places has a profound effect on how we benefit from them*
- *Psychological impact - the management, use and general ambiance of places has a significant effect on whether we feel at home.*

This meant thinking about the following:

- *access: getting into and around places and using them with ease and dignity*
- *treatment: treated with respect and consideration - welcomed, guided, and looked after by the people, the space and the systems*
- *function: facilities that provide us with what we need, and that work for each of us according to need.*

The Thomas Payne Study Centre the most recent addition to the University East Anglia's academic estate by R H Partnership was noted as an example of how the client was able to promote innovative building solutions that esteem their institutional background and demonstrates the success of their thorough tender process

Figure 3.6, University of East Anglia; An Example of innovation in design process: Photo by RH Partnership Source CABE (2011)

3.5.2 Future of E-learning Focused Buildings

According to Watson (2006) educational purpose should clearly be the drivers for educational building projects. Watson (2006) asserted that 'to undertake an educational build or refurbishment project and not produce a product that is fit for purpose from the day it opens would be unthinkable.' Watson (2006)'s view point was that as 'important as this is', much more vital was 'that any project must result in facilities that serve the unknown needs of the future'. Arguing that 'whilst we know how things are today, predicting what the future might be like is risky; the only certainty is that we don't know what it will be like'. Agreeing with this assertion, (Christensen, 1997 in Watson, 2006), states that *'not only is the future unknowable but we also know, that if our buildings are new and innovative they may initially perform less well than current facilities, hence, the dilemma. If we base our decisions on available evidence it's unlikely that we will ever change at all. If we base our decisions on an unknown future it may not measure up to current expectations'*. It was therefore her view that confronted with this situation; one had to be ready to take certain risks. Watson argued that "Forensic examination of data about the past, the major part of most planning strategies, will not produce innovative solutions for the future" but that what really mattered were the far reaching lessons which were obtained from the past, the 'weak signals in the current environment, and our beliefs and values about what we are trying to achieve.'

Furthermore Watson (2006) observed that "*we have to imagine the learning futures that we wish to create — and be prepared to be wrong. Such imaginings form the basis of a Creative World View approach to vision, strategy and planning proposed by George Land and Beth Jarman in their book Breakpoint and Beyond and described concisely in the* *following way: '. . . the reference point is the future, not the past. We don't need to fall back on the past for our decisions. Choices are based on alignment with our purpose and our vision for a different world'* (Land & Jarman, 1999 in Watson, 2006)."

Watson (2006) therefore claimed that possessing a "*clear vision and purpose, in this context about the future of learning, is a powerful driver of any educational building project that seeks to innovate. Clarity of vision is key to developing the brief for the project and managing the relationship with architects and designers to ensure that the final product delivers the vision*."

3.5.3 The Saltire Centre an Example of a Good Practice E-learning Structure

The focus of the article, by (Watson, 2006), was the role of the Saltire Centre in providing innovative learning spaces. It stated that the Saltire Centre at Glasgow Caledonian University opened on January 30th 2006. Its building is organised across five floors and has 10,500 square metres of space. The planning took three years from plan to completed build; it cost around twenty three million pounds including fit out, and was finished within budget and on time. It is a library, which has 1800 study spaces and provides a one-stop shop for the delivery of all services for students at the University.

Key Influences and Themes

It was explained that, 'there are many influences on any building project as the project and related conversations with interested parties' progresses'. Some of the key themes in respect of students and their learning that shaped the Saltire Centre, and which are of general interest in respect of educational building provision, were:

(i) Flexible open space

(ii) A spectrum of spaces

(iii) Our expectations of students

(iv) A role for conversational learning

(v) Learning as a social process

(vi) Some characteristics of modern students

(vii) The recognition of individual difference

(viii) The integration of IT in the building

(ix) The importance of design

(x) Third places

Each of these themes which influenced the thinking during the planning of the Saltire Centre was considered to be elements for good and Innovative design.

3.6 INFLUENCE ON AIM/OBJECTIVES

The above review of literature on the definition of e-learning, learning styles, physical space types and non-physical space types in learning environments as well as the current thinking and progress made by designers on the subject of designing technology supported learning environment in HEI goes to partly fulfil the research objective 2 –To identify essential user learning patterns that affect e- learning space design as well as objective 3- To develop a set of guidelines for good practice in e-learning space design.

The review also flagged up several examples of where these have been successfully implemented; thereby establishing the fact that the research aim is achievable as seen from the case studies reviewed. The progress being made in this regard was mainly from the designers' understanding of the subject matter. The reviewed works did not deal with the aspect of user preferences and criteria for achieving good design in HEI construction. It was thought that this aspect is a necessary factor that will be useful in developing guidelines for establishing the best practice approach to E-learning for future projects within HEI in line with the objective 4 of this research.

Consequently, the understanding of these issues underpins the research focus that was set upon and prevents misconception of the set task. The process of how similar research works aimed to achieved effective space design in learning environment and publications from industry practitioners on the design of e-learning spaces in HEI showed that well-designed spaces was seen to have a motivational effect, and that involving learners in the aspects of the design was an important factor that went a long way to determine the success of the use, functionality and replication of the e- learning spaces. This again goes to support the hypotheses that have been developed in this research.

3.7 CHAPTER THREE SUMMARY

This chapter focused on the review of e-learning space design with the aim of presenting an in-depth analysis of the subject area initially outlined in from of similar research. A critical analysis of issues that affect the good design of e-learning spaces with respect to users' requirement, learning patterns, technological advances and related factors was done. Review of literature showed that there were growing interest on the issue of space design within the Higher education Institution as evident in the works of scholars, however there was still a gap as identified in respect to focus on the E-learning space design with respect to the users and the design of the technology supported learning environment to this end, four main categories of space types which were the general teaching spaces, learning centres, vocational spaces and social spaces and their design demands were reviewed. It was understood from reviews that the user's requirement were vital in the designing of e-learning environments as shown by the findings on their learning styles; which suggests that learners were influenced by their learning styles which in turn influenced their learning outcome and not only the technology provided within technology –rich learning environments. The underlying concern from the reviews presented herein is however the question of how far the introduction of the technology within a learning space could hinder or aid the learning experience of the learner or even the future use of the space as it was understood from the review of literature that the requirement of users were divers but always changing as well as the type of technology provided while the space and its location would remain constant along with other elements within it.

CHAPTER FOUR - HISTORY OF EDUCATION AND UNIVERSITY BUILDINGS

Chapter four presents findings on the history and meaning of education, the historical background of university buildings and a review on the origin and history of higher education institutions (HEI) in general.

'A study of the history of opinion is a necessary emancipation of the mind. I do not know which makes a man more conservative- to know nothing but the present, or nothing but the past.'

John Maynard Keynes in 'The End of Laissez-Faire' (1926) reiterated by David B. Tyack in 'Education as a history' (1983)

4.0 INTRODUCTION

Education is considered to be a relevant and complementary aspect of the study being undertaken, as it relates to the history of university buildings and higher education institutions. Therefore, before embarking on the review and analysis of the history of university buildings and higher education institutions, and also in order to present a more comprehensive work which has relevance to the research endeavour, a general overview and understanding of the meaning and history of education, has been investigated and presented. It was thought that this background understanding may assist the reader and researcher in appreciating the definition, scope, complexities and variety of experiences and conditions being scrutinised here. Furthermore, it is also expected that the background information will also provide the reader with an insight into the philosophy and thinking of the chapter.

Also, this chapter focuses on the impact of four of the master educators (Plato, Aristotle, Locke and Jefferson), while presenting a general review on the evolution and background of university buildings and higher education institutions. The intention being to examine, (as stated by Tyack,1983) 'the trajectory of past events' over historical time lines; in order to understand what occurred in the past, and not to make speculations about what may happen in the future.

This chapter has been divided into three sections. The first section present's findings on the meaning of education with respect to important variables that influenced it such as education systems, learning modalities, psychology of education, philosophy of education, sociology and education, technology and education etc. The section after deals with the review on the historical background of university buildings from the beginning of man's existence up until the 21st century; the last section is a continuation of the second as it focuses on the review of the origin and history of higher education institutions (HEI) in general.

4.1 THE HISTORY AND MEANING OF EDUCATION

4.1.1 Definitions of Education:

Online Encyclopaedia (2010) states that; 'Education in the largest sense is any act or experience that has a formative effect on the mind, character or physical ability of an individual'. It further states that technically speaking, it is 'the process by which society deliberately transmits its accumulated knowledge, skills and values from one generation to another'. It explains that 'education is a concept, referring to the process in which students can learn something' and that the process comprises of I) instruction - 'the facilitating of learning toward identified objectives, delivered either by an instructor or other forms'; II) teaching – 'the actions of a real live instructor designed to impart learning to the student' and III) learning- 'learning with a view toward preparing learners with specific knowledge, skills, or abilities that can be applied immediately upon completion.'

'Etymologically the word education contains *educare*' which in Latin means to "bring up", which is related to *educere* which means to "bring out", "bring forth what is within", "bring out potential" and *ducere*, meaning to "to lead". (Online Encyclopaedia, 2010)

Britannica Concise Encyclopaedia (2010): defines education as: - 'Learning that takes place in schools or school-like environments (formal education); or in the world at large ; the transmission of the values and accumulated knowledge of a society'. It also noted that 'in developing cultures there is often little formal education; children learn from their environment and activities, and the adults around them act as teachers'. Also that in more 'complex societies, where there is more knowledge to be passed on, a more selective and efficient means of transmission — the school and teacher — become necessary'. It further explained that the duration and content of formal education, as well as the students who are taught have varied largely from society to society and 'age to age'. This is also true about the philosophy of education. Britannica (2010) also cited the example of philosophers such as John Locke who's philosophical approach to education was to view individuals as blank sheets on which knowledge could be written; compared to other philosophers like Jean-Jacques Rousseau who instead saw the 'innate human state as desirable in itself and therefore to be tampered with as little as possible'. This is the opinion that is usually adopted in alternative education.

'The act, process, or art of imparting knowledge and skill: instruction, pedagogic, pedagogy, schooling, teaching, training, tuition, tutelage, tutoring.' Also education was defined as 'Known facts, ideas, and skill that have been imparted: erudition, instruction, knowledge, learning, scholarship, science' (The online Thesaurus, 2010).

4.1.2 Education Systems and Types:

Research shows that there are various education systems which have been proffered by various scholars. However, these can all be broadly categorized under two main systems; formal or informal systems. Education systems in general spans across primary, secondary, tertiary up to adult education and beyond (Anon 4 online, 2010).

The right to education was initiated and accepted by some jurisdictions as far back as 1952, Article 2 of the first Protocol to the European Convention on Human Rights encourages all authorizing parties to ensure the right to education. At the global level, the United Nations' International Covenant on Economic, Social and Cultural Rights of 1966 enforced this right under its Article 13. (UN website accessed online, May, 2010)

This was echoed by Sir Ken Robinson (2006) while advocating for the creation of an education system that will nurture, and not undermine creativity in schools, Robinson mentioned that in recent years certain levels of education had been made compulsory for everyone in almost every country. He asserted that because of the increase in population and the propagation of mandatory education, The United Nations Educational, Scientific and Cultural Organization 'UNESCO' had estimated that in the next thirty years more people will be given formal education than in all of human history up till now(Robinson, 2006).

4.1.3 Education and Learning Modalities:

Over the past two decades, some studies about learning styles were done. Dunn and Dunn, (1992; 1993; 1999) identified significant stimulus which could control learning and influence the educational setting; almost simultaneously, as Renzulli, and Reis, (1997) who proposed change in teaching approaches. Identification of individual talents or abilities was done by Howard (1993; 2006) in his 'Multiple Intelligences theories', which was influenced by the works of the Myers-Briggs 'Type Indicator' and 'Keirsey Temperament

Sorter' ("Keirsey web-site"; 2009) as well as the works of Jung Carl Gustav in Dunne (2002). The article noted that Jung, had worked extensively on the understanding of how human personality affected the manner in which they interacted personally, and how this in- turn determined the way individuals responded to each other within the learning environment. Kolb and Gregory's (2009) research involved a comparable but more basic approach named the 'Type Delineator' ("Type Delineator description"; 2009).

It is currently acceptable to separate education into diverse learning "modes". The three learning modalities and perhaps the most universal as defined by Swassing, Barbe, and Milone, (1979) were:

'Visual: learning based on observation and seeing what is being learned.'

'Auditory: learning based on listening to instructions/information.'

'Kinesthetic: learning based on hands-on work and engaging in activities.'("Varied Learning Modes" online 2009)

Research suggests that, depending on their preferred learning modality, various educational techniques have varied stages of efficiency (Barbe, and Swassing, with Milone (1979), an implication of this presumption is that effective education ought to provide a selection of teaching techniques which includes all the above mentioned learning modalities in other for different students to have the same chance to learn in a manner that is efficient for them. (Learning modalities web-site; online 2009)

4.1.4 Technology of Education:

According to Jarvis, Holford and Griffin (2003; pp 126-127), technology was considered to be an increasingly influential feature in education, as more recently, media, audio- visual equipment for video-conferencing, audio-conferencing and tele-conferencing, as well as mobile phones and PCs have been used in order to complement well-known education practices and promote innovative ways of learning; for example long distance education of the British Open University. Thereby providing the learner the huge opportunity for interactive learning such that they can choose and study whatever they want. It was also asserted that, this scenario suggests an increase in 'programming and blogging' via internet between teachers and learners. They stated that technology presents influential learning tools requiring new skills and perceptions of students, as 'information technology makes possible a virtual learning environment or university or community' such that the traditional educational system of face to face interaction has been overtaken. From the foregoing, it can be seen that there now exists a greater use of technology in the teaching of students as well as in administrative duties in education. Other technology use in education includes, Online student assessment technology e.g. the Audience Response System (ARS), which enables immediate results and feedback on tests, tutorial sessions and discussions, evaluation, online courses, e-newsletters etc; a study environment that is made independent of time, place or space which is therefore more flexible and immeasurable (Salmon, (2000) in Jarvis et al 2006; p127).

4.1.5 Education and Information and Communication Technologies

Information and communication technologies (ICTs) were defined as different types of devices and materials used for corresponding, generating, distributing, accumulating, and controlling information usage." Blurton (2009) online; UNESCO website 2009) some examples of these technologies are computers, the World Wide Web, various means of communication technologies (like radio and television), and 'telephony' (ICT in Education, online 2009). Furthermore it was suggested that there was a growing concern on how education at all levels could be improved by the use of technology by policy makers at national and international levels as well as the cost implication of its adoption (OECD, 2001, CEC, 2002 in Jarvis et al p 127). The earlier ICT technologies, like the radio and television, have been used for open and distance learning for more than forty years, the birth of the British Open University in 1970 was thought to be the vehicle for the new information society in education (Jarvis et al, 2003: p11). However, print has been considered to be the most affordable, most available and as such, the foremost 'delivery mechanism in both developed and developing countries' (Potashnik, and Capper, 1998)

Other studies showed that computer and internet adoption were still at the early stages of uptake in third world countries, Taghioff (2003) argues that as a result of limited infrastructure and the supporting elevated costs of access these technologies were rarely used; but asserts that a combination of different types of technologies were used together rather than one type of technology as the only delivery mechanism. For example, the Kothmale Community Radio Internet uses both radio broadcasts and computer and Internet technologies to facilitate the sharing of information and provide educational opportunities in a rural community in Sri Lanka (Taghioff, 2003). The United Kingdom Open University (UKOU), established in 1969 was the first educational institution in the world completely devoted to 'open and distance learning, still depends largely on print-based materials backed up by radio, television and, more recently, online programming. (Open University, UK web-site 2009) likewise, the Indira Gandhi National Open University in India merges together the technologies of print, recorded audio and video, broadcast radio and television, and audio conferencing (Open University, UK web-site 2009 accessed Online, May 2010).

4.1.6 Philosophy of Education

Philosophy of education is defined as the 'philosophical study of the purpose, process, nature and ideals of education' (Online Encyclopaedia, 2010). It also states that philosophy of education can logically be seen as a part of both philosophy and education. Studies on the philosophy of education is usually carried out in schools and departments of education, even though it is applied philosophy, originating from the customary 'fields of philosophy (ontology, ethics, epistemology, etc.) and approaches (speculative, prescriptive, and/or analytic)' in order to deal with problems on the subject of 'education policy, human development, education research methodology, and curriculum theory', and much more (Anon 5, online 2010).

4.1.7 Psychology of Education

Psychology of Education is defined as 'the study of how humans learn in educational settings, the effectiveness of educational interventions, the psychology of teaching, and the social psychology of schools as organizations' (Wittrock, 1992). The research into human learning has gained pace over the past century (Jarvis et al, 2003) though the phrases "educational psychology" and "school psychology" were frequently substituted for each other, researchers and theorists are likely to be identified as educational psychologists, while consultants in schools or school-related settings are identified as school psychologists. It was also noted that the concern of educational psychology was with the processes of educational achievement in the universal population as well as in 'sub-populations such as gifted children and those with specific disabilities' (Wittrock, 1992).

Educational psychology could somewhat be understood by its connection with other disciplines according to Wittrock (1992) in Gill (2005). The article stated that 'Educational psychology is distinctive from other areas of educational research because of its psychological background, the focus on the learners and the teachers, and its responsibility to contribute knowledge and theory to psychology' It is informed principally by psychology, having a connection to the discipline similar to that of the relationship between medicine and biology. A wide range of specialities within educational studies were informed by educational psychology, such as 'instructional design, educational technology, curriculum development, organizational learning, special education and classroom management'. 'Educational psychology relies on and contributes to cognitive science and the learning sciences'. In universities, departments of educational psychology are generally accommodated within faculties of education, possibly a basis for the absence of the representation of educational psychology content in introductory psychology textbooks (Lucas, Blazek, and Raley, 2006).

4.1.8 Sociology of Education

'The sociology of education is defined as the study of how public institutions and individual experiences affect education and its outcome', or 'how social institutions and power affects educational processes and outcomes, and vice versa' (Durkheim, 1964; Parsons, 1951; Merton, 1968 in Jarvis et al, 2003: p44). It was also stated that Sociology has contributed to our perception of learning through its concept of socializing. Education has been understood by several people as a means of overcoming restrictions, attaining higher equality and attaining wealth and status for everyone (Sargent, 1994). Learners may be motivated by aspirations for growth and development therefore education has also been perceived as a place where children can develop according to their unique needs and potentialities (Schofield, 1999). The purpose of education can be to develop every individual to their full potential. The sociology of education is the study of schooling. It is most concerned with the public schooling systems of modern industrial societies, including the expansion of higher, further, adult, and continuing education. (Marshall, ed., 1998)

4.1.9 History of Education: Prehistoric Era

The history of education according to Dieter Lenzen, president of the Freie Universität Berlin 1994, "began either millions of years ago or at the end of 1770". (Hughes and More 1997) the review of literature suggests that 'education as a science cannot be separated from the educational traditions that existed before'. In which grown-ups taught the children of their societies the information and expertise they were required to master and ultimately transfer to the next generation after them. The evolution of culture, and human existence was based on this practice of knowledge transmitting. In pre-educated societies this was accomplished verbally and through miming or replication. 'Story-telling' persisted from one generation to another. Eventually at an older age, the young were then able to obtain a more structured and formal instruction, imparted by persons outside their nuclear families. Such training were often in the 'context of initiation, religion or ritual' (Hughes and More (1997); Adeyemi, Adeyinka and Augustus (2002); Atkinson (1998). Spoken/ verbal communication ‘developed into written symbols and letters’. The intensity and extent of knowledge that was preserved and transferable subsequently increased exponentially. As cultures began extending their knowledge further than the fundamental skills of communicating, buying and selling, hunting for food, religious traditions, and the like, formal education, and schooling, ultimately began. Meanwhile, education in this intelligent manner had already been in existence in Egypt between 3000 and 500BC. (Kendall, Murray, and Linden, 2004).

The history of education is an account of the past processes used in teaching and learning. From the onset of human evolution and writing, every generation, had tried to impart cultural and community values, customs, ethics, belief and expertise to the subsequently generation. (Kendall, et al 2004) ‘The transferring of culture is also known as enculturation and the learning of social values and behaviours is socialization. The history of the curricula of such education reflects human history itself, the history of knowledge, beliefs, skills and cultures of humanity’ (Compayre, translated by Payne, 2003).

As the culture and knowledge of prehistoric civilizations became more complicated, acquisition of various types of skills must have increased accordingly. Such skills may have also been learnt on the job, in areas such as; ‘animal husbandry, agriculture, fishing, preparation and preservation of food, construction, stone work, metal work, boat building, the making of weapons and defences, the military skills and many other occupations’ (Ong and Walter, 1982).

After the development of writing, the documentation of stories, poetry, knowledge, beliefs, and customs became possible and were then transferred with more accuracy to other people on a wider scale and subsequently to the next generation. However the spread of literacy was slow in several societies, predominantly verbal communication and illiteracy was still affecting most of the population for centuries and even millennia. (Ong and Walter, 1982) Literacy in preindustrial societies was associated with civil administration, law, long distance trade or commerce, and religion. (Foster and Purves, 2002) A formal schooling in literacy was often only available to a small part of the population, either at religious institutions or for the wealthy who could afford to pay for their tutors. The earliest known universities, or places of higher education, started teaching a millennium or more ago (Anon 6, 2010).

4.1.10 History of Education in the Nineteenth and Twentieth Century

The earliest period and the most commonly used approach in the history of education as suggested in the forward written by Tyack, in Silver (1983) was the research into 'the social philosophies and pedagogical theories' of master educators from Plato to Herbart and Dewey. Tyack argues that most often the documentation of assumptions rather than the actual impact of these great minds were done by historians. Adding that a historical excursion into how people have studied and reinterpreted their world was however, nicely expressed by Silver (1983) in his book. Tyack, also quoted that 'a study of the history of opinion is a necessary preliminary to the emancipation of the mind' and as such it was important to understand that 'ideologies and opinions do not float in space; but they arise from particular social strata, serve particular groups and interests and changed overtime as the relations of people change.'

Silver (1983, pp. 4-5) expressed the opinion that the history of education was in actuality numerous histories, he argued that this was because education was itself not a simple and homogeneous notion or category, and also because its history could be investigated with respect to almost continuous variables. Silver (1983) asserted that whether education, was thought of as it were to be an 'indefinite cluster of experiences or as a more narrowly definable process related to a variety of other processes', it lacks meaning when it is defined in secluded and disjointedly 'institutional terms' He stated that the initial outline of the history of education in the nineteenth and twentieth century could be based on several personal qualities and socially desirable skills and categories for which education may be seen as preparation. He also asserted that education at that period may have been seen as a way for achieving compliance, finding contentment or encouraging originality, or the fulfilment of human potential, or maturity, employment and future citizenship.' He noted that, that was the case as the history of education in the nineteenth and twentieth century's flourished with declarations and interest groups who had in some ways followed such constructively articulated goals, and wanted to improve the system, the classroom or the curriculum or perhaps the teacher and the training they received in order to achieve such goals. Silver (1983)'s opinion was that some of the promoters of these could have been utilitarian's or progressives, theosophists or industrialists, Christians or secularists, socialists or conservatives.

4.1.11 Higher Education in the Nineteenth and Twentieth Century

Silver (1983) also states that in the twentieth century, higher education and its relationship to the professions, employment, technology, commerce, industry, public-service, had attracted a lot of attention in controversies about the liberal and vocational. He noted that the approach to twentieth century thinking about higher education had to be hinged on 'unsystematically explored materials of various kinds- speculative, prescriptive, campaigning, impressionistic, autobiographical, research-based on various scales and at one or another level of sophistication, along with policy statements by individuals, official and unofficial bodies' he also observed that in British debates, on higher education institutions, rather the main discuss being about the industrial and technological expectations of HEI, and the type and position of the appropriate studies in older, modified and newer institutions, that it had been instead on the effect of economic, technological, industrial and broader social reforms and predicaments and which had in turn greatly underlined the issues of institutional scale, scope, structure, curriculum and values.

Silver (1983) noted that twentieth century attitudes towards higher education were more easily grouped and understood with respect to theme and concept than in rigid chronological sequence. Arguing that the histories of higher education in Britain tended to concentrate either on the internal development of institutions or the policy and policy – related thinking- majorly influenced by government and its committees.

4.2 THE HISTORICAL BACKGROUND OF UNIVERSITY BUILDINGS

In order to understand, this section, the meaning of a university was looked at from the onset as it was thought to be useful and as such the findings have therefore been presented hereunder.

4.2.1 Definition of a University:

University - the body of faculty and students at a university; where body means 'a group of persons associated by some common tie or occupation and regarded as an entity' (Oxford English Dictionary, Online: 2010)

University – 'establishment where a seat of higher learning is housed, including administrative and living quarters as well as facilities for research and teaching' (OED, Online, 2010)

University - a large and diverse institution of higher learning created to educate for life and for a profession and to grant degrees (OED, Online, 2010)

Oxford English Dictionary defines the world university, as ‘the whole body of teachers and scholars engaged, at a particular place, in giving and receiving instruction in the higher branches of learning; such persons associated together as a society or corporate body, with definite organization and acknowledged powers and privileges (esp. that of conferring degrees), and forming an institution for the promotion of education in the higher or more important branches of learning; also, the colleges, buildings, etc., belonging to such a body’.

Anon 4 (2010), ‘A university is an institution of higher education and research, which grants academic degrees in a variety of subjects. A university is a corporation that provides both undergraduate education and postgraduate education’.

The word university is copied from the Latin ‘universitas’ ‘magistrorum et scholarium’, more or less meaning "community of teachers and scholars." (Google eBook of Encyclopaedia Britannica).

Neuman (2003) reiterates that, Shadrach Woods of Candilis, Josic and Woods, Architects for the free University of Berlin (1965), said they ‘considered the university as a tool and as a place’ even though all of its function may not be known. They based this definition on a working hypothesis that the university’s function was that of encouraging and exchanging academic regeneration between people in different disciplines, in order to enlarge the scope of man’s knowledge and also increase man’s control over his communal and personal activities. It can then be assumed that a university is made up of a community of scholars, within various disciplines seeking to increase man’s knowledge and understanding of his world.

According to Neuman (2003) the modern university of today arguably may be made up of all or some of the following general facilities. Libraries/Learning Centres, Academic buildings and Professional Schools, Science Teaching and Research Facilities, Housing, Athletics and Recreational Facilities, Social and Support Facilities, and Cultural Centres. His book suggests that, the planning, architecture and landscape as well as the physical relationship between these facilities continued to be critical issues in nearly every institution because; they affect the background that sustain the mission of the institution; create the identity that the institution portrays to the world; and more importantly help in maintaining the status that the institution enjoys among others. Neuman (2003) opinion that the campus of an institution is an important component of its very existence and survival adding that the campus (the university as a whole) was not just left over spaces between buildings, but that it was in reality a chain of designed places that reflected the values for which an institution wanted to be identified by; describing the university as a 'culturally dynamic and complex' environment that should be safe while encouraging participation and enhancing social interaction amongst all such that it should appeal to students, faculty staff, and visitors on many levels.

4.2.2 The Search of Knowledge by the Primitive Man

Research shows that the origin of universities and what they represent can be traced back to man's most primitive search for knowledge, his most basic urge to comprehend, evaluate and somehow control his surroundings, trying to explain both the world and his experience of it (Pierce, 2001).

The review of literature on the historical background of university buildings indicates that the first documentations of man's experience date back from Palaeolithic periods, about 35,000 years ago. The images at Altamira and Lascaux were said to portray scenes painted on, or carved unto rock facades in remote caves. The scenes portrayed paintings of human like symbols, animals, landscapes and aspects of communal life such as dancing or ritualistic acts. (Pierce, 2001).

According to Pierce (2001), several theories have evolved in order to try and explain the meaning of these paintings and what they represented. Some of the school of thoughts were based on assumptions that the scenes represented fertility rights, or possibly were meant to ensure successful hunting, or that they were some sort of mystical or magical offerings to unknown gods? However, what is most important apart from all these theories is the idea that man's earliest ancestors made efforts to understand and control their world as it were.

Pierce (2001) states that in modern day, the pursuit to get an understanding from our existence was adequately expressed by the late Carl Sagan in his introduction to Stephen Hawking's, *A Brief History of Time:*

"We go about our daily lives understanding almost nothing of the world. We give little thought to the machinery that generates the sunlight that makes life possible, to the gravity that glues us to an earth that would otherwise send us spinning off into space, or to the atoms of which we are made and on whose stability we fundamentally depend. Except for children (who don't know enough not to ask the important questions), few of us spend much time wondering why nature is the way it is; where the cosmos came from, or whether it was always here; if time will one day flow backwards and effects precede causes; or whether there are ultimate limits to what humans can know. There are even children and I have met some of them, who want to know what a black hole looks like; what is the

smallest piece of matter; why we remember the past and not the future; how it is, if there was chaos early, that there is apparently, order today; and why there is a universe."

Pierce (2001) mentioned that Sagan and Hawking explored the depth of space, by using the most recent technological equipments created by man in search for explanations. He then argues that their inquisitive nature is driven by the same basic human need that motivated man's earliest ancestors to portray his world through paintings: the desire to reveal human knowledge. This he explained as "an essentially philosophical quest" which originated from the "adjective's etymology: the Greek *philo* meaning love and *sophos* meaning wisdom".

4.2.3 The Schools of Plato and Aristotle

History records that the great philosopher Plato began the purposeful assessment of data about 2,400 years ago, and that his writings were thought to have presented us with the initial "systematic analysis and methodology" such that man's curiosity and comprehension of the world could be well thought-out i.e. structured. Plato on the other hand began from the straightforward view that: 'Philosophy begins with wonder.' His opinion that speculation and investigation are essential to human nature is currently a major ethos of all higher education institutions as human quest for information has remained vital. (Pierce, 2001) furthermore, it was explained that Plato's quest for knowledge was hinged on determining the legitimacy of explanations in a persistent search for complete accuracy by using a methodology of 'dialectic' procedure where theories were presented and then tested against opposing suggestions and ideas. Also Sir Kirl Popper described this as a method of speculations and contradictions which is generally seen in all areas of education universally. In 387 BC Plato went on to start the famous Academy; which was also sometimes referred to as the first university. There he tutored many students (amongst who was Alexandra the Great) by encouraging a method of enquiry which motivated people to reason by themselves in the quest for knowledge. The famous Aristotle was Plato's student at the academy for 20 years. However, Aristotle preferred another approach to understanding the world and learning in general.

Aristotle's views were based on classifying the various aspects of human experience instead. History records that it was Aristotle's methodology that brought about the existence of various disciplines such as logic, physics, economics, psychology, metaphysics, meteorology, rhetoric and ethics. It was also stated that his approach led to the logical structure that grouped these disciplines into faculties, departments and areas of study which are seen in our present day universities. However it is thought that apart from the important educational approaches and structures put in place by the two master scholars, there are very little similarities to what is understood today as a university especially with respect to the physical structures Pierce (2001).

After the fall of the Roman Empire, ancient civilization went into the Dark Ages. During this period, a major change in the form of education occurred, influenced by the rise of Christianity and with it, believe and teaching in the divine explanation for human experiences, written out in a few important texts referred to as scriptures. This replaced what the ancient Greeks taught and believed i.e. in man's ability to reason and enquire about his world on his own. The approach was called scholasticism and it dominated the Western education for over nine centuries thereby limiting the enquiry of scholars to the preservation and interpretation of God-given Scriptures. However the task of preserving the divine texts and their keepers in order to pass them unto future generation was difficult. The translation of Aristotle's writings in the 13th- century from Arabic to Latin later reversed this and once again brought to the centre of academic endeavour his initial concept of enquiry and reason to be based on man's ability rather than on the divine Pierce (2001).

4.2.4 The Medieval Universities.

Research shows that before the formal creation, of medieval universities, a lot of medieval universities were kept for 'hundreds of years as Christian cathedral schools or monastic schools ('Scholae monasticae')', were classes where students were educated by monks and nuns; proof of these immediate predecessors of the present university seen at several places dates back to the 6th century AD. Riché (1978). The first universities were as follows, 'the University of Bologna (1088), the University of Paris (c. 1150, later associated with the Sorbonne), the University of Oxford (1167), the University of Palencia (1208), the University of Cambridge (1209), the University of Salamanca (1218), the University of Montpellier (1220), the University of Padua (1222), the University of Naples Federico II (1224), the University of Toulouse (1229)' (Anon 7, 2010 –The origin of universities, excerpts from Cox, (2000).

Furthermore, research states that most of the new universities were later founded from the schools that were pre-existing during the early medieval period; most often when these schools were perceived to have grown into principally places of higher education.

Many historians believe that universities and cathedral schools were a furtherance of the pursuit of learning endorsed by monasteries (Anon 7, 2010).

According to Pierce (2001), the development of the university during the 'Middle Ages', was directly related to the organization and expansion of craft guilds. Pierce (2001) noted that while the scholastic world was predominantly occupied with the preservation of scriptures, the secular world had built up a system of practical education by grouping together trades and similar skills in the form of guilds. Craft guilds or unions therefore existed as far back as the time of imperial Rome in form of groups of people having similar interests, who also aspired to establish their position and preserve their skills from external influence. Examples of these were unions of jewellers and masons. A system of apprenticeship was put in place, whereby the younger men were encouraged to train and learn by observing a master in order to acquire the skills of a particular trade. The apprentice then went on to become a master himself and was allowed to practice his trade and also train more apprentice as well thus the skill was passed down over time. The unions grew from just a group of people with similar interests into regulatory bodies that made sure that members maintained their competence by creating standards; they aimed to guard their status within the society and also control their business environment. In order to recognize its own status, each guild established individual forms of legislations and rites of passage from apprenticeship to master, with persons admitted to join the different levels expected to perform a series of mandatory ceremonies to portray the achievement of progression in this regard. Meanwhile, in the non-secular world the introduction of novices to the priesthood facilitated the development of monasteries and cathedral schools which were mainly focused on the teachings of theological education. A major one of such schools was the Chartres, outside Paris. (Dated as far back as the 4^{th}-century) followed by the Gothic Cathedral of the 11^{th} –century.

Pierce (2001) stated that towards the end of the 13^{th}- century the increase of towns and cities brought together the activities of the unions and those of the theological schools which then brought about the evolution of the first universities as they are known today. A university can be seen as 'a place of learning and research, a community of students and teachers or a collection of buildings' Pierce (2001). However, the definition of the word university originates from the Medieval Latin word '*universitas',* meaning 'a corporation, society or community of any kind, made up of individuals sharing a common interest and having independent legal status.' Pierce (2001). The word therefore it did not refer to the universality of knowledge and could mean any group from a craft union to a public company.

Pierce (2001) argued that the term *'stadium generale'* was probably closer in meaning than *'universitas'* to present day definition of a university because '*stadium'* represents the perception of a place or school of learning, while *'generale'* has to do with the range of learners and educators it brings together rather than the range of subjects studied. Furthermore, he argued that the reason why these people would wish to associate with each other would mainly be for the purpose of 'dissemination of knowledge through sharing experiences and ideas' and 'beyond this, the wish to advance understanding and the limits of knowledge itself.' He thought that the earliest universities attempted to create an environment which will help in promoting and cultivating the spirit of enquiry and research.

Retrospectively, Pierce (2001) explained that Plato initiated the theoretical structure for learning and from his work, the categorisation of subjects into faculties, disciplines and the present curriculum taught in modern day universities became possible. While Aristotle his student attempted to develop the various branches of knowledge. His work then led to the identification of the seven liberal arts namely; grammar, logic and rhetoric (*known as the trivium*) and arithmetic, geometry, astronomy and music (*known as the quadrivium)* in addition to these, were two more subjects; medicine and architecture. The ancient scholars considered this two groups of subjects i.e. trivium and quadrivium as the main foundation of philosophy arguing that those subjects classified as the *trivium* enlightened and informed the mind while the mind found it's expression through the later subjects classified as the *quadrivium.*

Pierce (2001) noted that in the 12th century, attempts were made by various educational bodies (Chartres) to allocate equal levels of importance to the seven liberal arts which were considered to be as the foundation for education. This equality he stated was unachievable as some subjects were later discarded. However, two levels of grading were introduced. These were lower and higher grades. The trivium was graded as the lower and considered to be equivalent to a bachelor's degree and the quadrivium the higher equivalent to a master's level degree.

After Aristotle's writings were rediscovered, the dialectic and logic schools of thought became more relevant as a shift in the thinking from the scholastic proposition and recognition of knowledge as being unquestionable and divine to the recent confidence and belief in man’s ability to undertake original investigations that could prove facts as a result of methodical examination.

4.2.5 The Design and Architecture of Universities

Pierce (2001) explained that the education systems of the modern institutions of today were modelled after the early medieval universities, though they were very different in their physical structures. The first generation universities as mentioned above were often originated when people came together with a common goal. Their initial meetings were often held albeit in an unplanned manner, in venues such as rented auditoriums or spaces. These universities were also an integral part of the towns and cities in which they were. Subsequently, identifiable territories were produced as a result of the increase in influence which led to the emergence of the establishment of colleges, connected to residential groupings of scholars and students. Worthy of note is the fact that the universities developed as part of the cities and towns such that in present day, some particular territories like colleges are identifiable, then they grew alongside with the growing urban fabric. Examples are the universities of Oxford and Cambridge as they grew and developed from the thirteenth century till date.

From the fifteenth century to the nineteenth century students that wanted to pursue their university education elsewhere had to travel out to Scotland or Ireland. In Scotland, the options were the universities of St. Andrews founded 1410; Glasgow, 1451; Aberdeen, 1494 and Edinburgh, 1583; while in Ireland it was the Trinity College, Dublin founded 1591. It was in the mid-to-late nineteenth century that there was a recorded growth in the foundation of new universities in England and Wales.

4.2.6 The Earliest American Universities

Pierce (2001) records that the early American universities began to develop a new symbolic representation (typology) for the learning environment even before the expansion of universities began in Britain. Harvard University, founded in 1637 is America’s oldest academic institution. It is said to have developed within the ‘Oxbridge typology’ alongside University of Princeton and Yale University; its surroundings was concentrated on ‘hall buildings, and residential colleges’. The idea of a unified campus design started to unfold at William and Mary College, Williamsburg, Virginia and at Union College, Schenectady, New York. Although the first and main steps taken in the process of university design and organization has been attributed to Thomas Jefferson.

4.2.7 The Influence of John Locke on University Development

John Locke (1632-1704) was said to be a politician and philosopher and is seen as the progenitor of Jefferson's thinking and historians also believe that he was the person responsible for most of the development in education which has taken place from late nineteenth century until now. Locke questioned the acknowledged perception about the way in which we learned in his masterpiece, *'Essay on the nature of Human Understanding'*. His revolutionary opinion was that man was born with *'no a priori knowledge'* which meant that man had neither inborn initiatives nor abilities, but that the mind was a blank sheet of paper, or '*tabula rasa',* upon which experience writes. He further argued that 'by generalising from our experiences, a process called induction' we were then able to create theories about our world, which would then give us enough but not final explanations that allow us to behave reasonably and creatively. Locke also concluded that men were all equivalent at birth and that one's progressive growth was based on the 'nature and variety of experiences' as well as the consideration given to the associations between, and the explanations of these occurrences – effectively our education. This notable revolution in education occurred simultaneously alongside the revolutionary works in science by Sir Isaac Newton and others. His work meant that for ever since the ancient Greeks, man for the first time now had the boldness to accept that his own control of observation and logical analysis were the main tools for attaining a comprehension of his world.

Locke's assertion that all men had the potential for development and self- improvement has now become one of the pillars of university teaching. Furthermore his opinion that man's ability was not restricted by innate characteristics that were drawn from his society or cultural environment has also been adopted as one of the governing guidelines of democratic societies globally. This innovative thinking is considered to have had a major influence on the founding fathers that wrote the first constitution of the United States of America.

4.2.8 The Influence of Thomas Jefferson: - The University of Virginia

Pierce (2001) mentioned that further to the open-minded ideas of John Locke, a major exodus in educational thinking with new legislation was established by Thomas Jefferson who history records was a revolutionary educational thinker, a statesman, lawyer and ambassador- and the third president of the United States. The new legislation gave rise to a 'state university system' which then led to the founding of the University of Virginia.

Pierce also recorded that in addition Jefferson was also a brilliant part-time architect whose design for the campus of the University of Virginia depicted a new concept for the construction of a university, its layout and administration. Jefferson combined the architectural language of the ancient classical order with the idea of a liberal democracy, by an open planning system and the founding of campus architecture. It was said that Jefferson was motivated by the renaissance concepts of 'Palladio', in which 'the pavilion in the landscape evoked the clarity and potential of man's rational understanding in contrast to the chaos of the natural world'.

To achieve this perfect educational environment, Pierce (2001) stated that Jefferson invented a set of pavilions organised around a huge communal space called 'the lawn'. This then became the central point of what he called an 'academic village' which then led to the creation of an 'academic community' wherein the members would cohabit as families with each building serving as the accommodation for a professor, the upper floor area serving as the residence while the ground floor was to be used as the lecture hall. The building types however differed from each other in design and layout depending on the use for which it was intended and they were all connected through a covered walkway in order to foster the idea of 'an individual collegiate model but within an overarching unitary university'. Pierce (2001) records that a major middle point of the design layout was the 'rotunda' 'modelled on the Pantheon and in part borrowing references from Bouelé's cenotaph to Sir Isaac Newton'. The building was said to contain lecture rooms, a library, public areas and the like and that it was centrally located on the campus, 'the intellectual heart of Jefferson's campus design' symbolising his impression of a perfect type of academic environment..

The model devised by Jefferson was thus adopted and used within the state system across most of North America and Pierce asserts that it developed to become the most commonly used model for new universities globally. Pierce (2001) mentioned that at the beginning of the twentieth century and after the Second World War the model was used during the expansion in higher education as well as in the expansion and setting up plans approved for the fast development of universities.

Pierce (2001) stated that the establishment of new universities in England was done in a modest manner during the nineteenth century. Durham was established in 1832, followed by University College London in 1836, University of Manchester 1860 and Cardiff in 1893. Pierce also explained that the London City University was very prominent and renowned because of its educational approach and change attributed to Jeremy Bentham a co-founder of the university was also seen as a radical social reformer. When he became fed up with the educational and religious system of belief of university of Oxford and Cambridge, he looked for an academic environment that allowed more freedom of thought. He believed that the interests of the society and that of the individual were unified. Bentham's philosophy was impartial and practical, promoting the best educational opportunities for everyone irrespective of their background. This philosophy was incorporated into the mission statement of London City University '…To continue its founders' vision by providing educational opportunities of the highest quality to all, regardless of background.'

4.2.9 The Four Generations of Universities

Pierce (2001) states that those four different architectural generations could be recognized in recording the history of universities since the 'Middle Ages'.

I) The examples of the first generation universities were Paris, Bologna, Oxford, Cambridge, which were all integrated with their original cities. According to Pierce's discussion on Christopher Alexander's account of the University of Cambridge, He claimed that its growth was so entrenched in that of the host city that, at definite places, Trinity Street was almost physically impossible to differentiate from Trinity College; as the buildings on the street held stores and coffee shops, as well as banks on the ground level while the spaces on the upper floors above these were used for undergraduate teaching. Such that in several instances, the original structure of the street buildings dissolved into the structure of the ancient college to the level that neither could be changed without this affecting the other.

Pierce (2001) narrates that the resulting intermingling of academic activities and city life style was considered a merit by Alexander as seen in some of the first generation institutions like Cambridge, however, Pierce (2001) stated that in some instances, the city life became controlled by the university and its interests. Whereby the balance between the academic and civic life had been so much changed in a way that the existence of the city was solely through the university.

II) The arrival of the second, '*redbrick*' generation of universities, defined by the Oxford English Dictionary as 'British universities founded in the late nineteenth and early twentieth century in a major provincial city, typically having buildings of redbrick (as opposed to stone); (later also) any recently founded or created university; that was in contrast with Oxbridge' Pierce (2001) noted, 'marked an opening up of education through regionally based institutions' who initially got candidates ready for the traditional examinations, but as time went on also attained their own proficiency and award granting position.

III) The third generation of universities wanted a physical repression from their original cities by establishing 'out-of–town campuses' which was in huge contrast to the form of university and city developing jointly inside the urban supporting structure or enclosure that had been in existence. Pierce (2001) explained that this came about as an after effect of the post-war explosion in opportunities for higher education studies and the proportionate requirement to quickly set up new institutions in addition to the adoption of Thomas Jefferson's idea of the academic village, which was independent in location and function. Some examples were those of Sussex, York and East Anglia, where the cities evolved in line with their individual respective commercial programme in which case they only functioned as a type of service provider to the satellite campuses. Here the architecture of the universities were divorced from that of the cities as it were a separation of everyday life from the world of academia was the case as noted by Donald Schon (1999), who described the irony of divorcing everyday life from the world of academia and asserted that while rationally, the relevance of research to the world of daily concerns is a subject for all universities, irrespective of their history or physical location, the independent campus had only been able to underpin this perceived separation.

IV) The fourth generation of universities were considered by Pierce (2001) to still be in the early stages of development. These he stated were founded on the realisation of the fact that several institutions could provide higher education studies to the same standards compared to the reputable universities. Also that in addition, the transformation in the funding arrangement as well as the expectation of the people regarding admission to higher education, as well as the beginning of global education had contributed in persuading the well-known institutions to re- evaluate their conventional function.

4.2.10 Educational Changes and its Impact on Space Design of Higher Education Institutions

According to Pierce (2001) the universities then saw themselves being stirred away from being givers of only full-time education, towards the direction of becoming organizations that offered specialised academic awards. The increased access to higher education supported other ways of part-time or distance based learning systems. Also the emphasis on credit accumulation and transfer enabled students to direct the course of their education through a variety of institutions; a pick and mix scenario. The idea of lifelong learning also came into play as a result of these changes, thereby motivating universities to create selections of short courses most times extracted from the full time course outline.

According to Pierce (2001), the educational structure of academia had also been subjected to a radical transformation. There were profound alterations from a 'teaching based culture to a student –centred learning environment' which had in turn brought new requirement on the type of resources the universities provided. Such that 'learning resource centres' took the place of libraries and seminar rooms; 'e-mail addresses' took the place of staff rooms and common rooms, while computer aided assessment replaced examination rooms. The expectation of students from staff and vice-versa had also changed; from being unreceptive note-takers and receivers of given wisdom, students were encouraged to adopt a more pro-active role of participation in their education to the end that the expectation of students regarding the quality of education has changed. The 'educational consumer' demands value and delivery.

Pierce (2001) asserts that there was an evident shift towards a learning society. The twenty-first century began with the basic constituents of knowledge and learning from postmodern consumption, such that the reality of modern higher education depicts a catastrophic change that has had profound repercussions for university architects. He argues that though the prestigious commissions for cash- rich Oxbridge colleges still persist, but that these on an international scale were more or less insignificant. New universities of necessity had to commission a range of new constructions as well as new construction types to meet up the demands of growing student statistics and alterations in the system of education. Academic structures had to represent the goals and position which the institutions desired to attain and portray. The value and reputation that architecture could provide as an external representation of an educational body has been acknowledged quickly by the new universities. Education is intangible whereas architecture enables it to become visible and appreciated just like the Medici in Renaissance Florence, new universities could be seen as significant architectural showcases that stood out from the onset of the twenty-first century.

Architects now had the extraordinary privilege to study and create new types of constructions for education, as a direct result of the general knowledge that there was a demand for provision of aesthetically pleasing motivational and extremely functional environments.

In essence architecture played an important part in conveying the message a university desired to send to its staff, students and the community at large.

4.3 THE GROWTH OF HIGHER EDUCATION INSTITUTIONS IN THE UNITED KINGDOM THROUGH THE TWENTIETH CENTURY

During the twentieth century, some of the academic institutions established in the United Kingdom were: Liverpool in 1903, Leeds in 1904, Sheffield in 1905, Belfast in 1908 and Bristol in 1909. After these, Pierce (2001) asserted that the expansion of such institutional buildings ceased mainly as a result of the economic and social effects of world war one and two. The group of the above mentioned institutions and their predecessors along with the new ones were often identified as ‘redbrick’ because of the main architectural style of that period and the intentional departure from the well-known style of education of the older well established universities (as defined in 4.2.7 above) these were the older group of universities comprising of Oxford, Cambridge, London and Scotland. The redbrick institutions were the second generation of Institutions. They were known for the absence of the grandeur and social privilege of Oxford and Cambridge. Their purpose i.e. the new universities was to give equal access to higher education for all thereby replacing the way universities had operated for the past 500years in which case only the socially privileged had access to study. That is why most of the first set of graduates from the municipal-school came out from the new universities. The universities in London were unique as they accepted people nationally and internationally such that they had a wide intake due to their central location in the capital unlike the other institutions which admitted students mainly from their geographical location.

Initially the ‘redbrick’ institutions were considered to be technical institutions that taught only the subjects related to common, everyday life and also got students ready to take the London degree exams. Therefore, these institutions had to work hard to attain their identity and specialisation in various fields of expertise in order to prove that though they were different, they were equal to the established Oxbridge universities. They were able to successfully maintain that status and eventually obtained the right to also award and confer their own degrees (Pierce, 2001).

Research indicates that the hugest development in university expansion in the United Kingdom occurred in the period from 1960-1970. Pierce (2001) noted that The 1963 Robbins Report recommended that more institutions be established beyond what was already being created. This led to an increase in the establishment of higher education institutions to almost twice the number of those existing before that time from twenty-two to forty-six institutions. ‘About thirty polytechnics were established from existing colleges and higher education institutions’ with the idea that these would provide educational opportunities for part time studies in degree and vocational courses. A system for regulating and awarding degrees called the Council for the National Academic Awards was created as the polytechnics were unable to award degrees initially. Due to the increase in academic opportunity, student numbers increased enormously and soon the CNAA started to award more degrees than all the collegiate universities combined. Pierce (2001) mentioned that in 1991 the government white paper ‘Higher Education; A New Framework’ announced that polytechnics were to be authorised to begin awarding degrees and university titles albeit within a unified funding educational structure.

4.3.1 The Development of New Higher Education Institution Buildings

In order to cater for the expansion of new institutions that was established from 1960-1970, several new ‘Greenfield campuses were constructed’. Amongst which were the developments of East Anglia, Sussex, Essex, and Warwick. Similar to Jefferson’s at University of Virginia almost about a hundred and fifty years prior to that time, the new universities presented with a ‘tabula rasa’ with regards to their design, became an outstanding challenge for architects’

These identified the onset of the third generation of university growth and their expansion was very rapid. Student numbers grew to about 3000 within the first ten years of their creation. Prior to this, Pierce (2001) stated that there had been a slow generic type of growth, such that now the architects of the new universities were confronted with the task of producing master plans as well as that of social engineering- of major concern was how the fast expansion could be managed by phased execution of a ‘strategic plan’. The ‘Architectural Review’ of 1963 noted that Lionel Brett suggested that the approach used should be varied significantly among the architects who were assigned similar projects with regards to the scope and completion time required on the independent Greenfield sites. He also observed that there were three design solutions which came about from the architects’ point of view on how the growth ought to be managed.

As noted by Pierce (2001), Sir Basil Spence’s plan for the University of Sussex symbolized the ‘campus model’; having a centrally located and powerful looking main building as it’s beginning and from which the rest of the structures would get their bearing and expand outwards. He used a ‘system of precast concrete vaults and brick construction’ reminiscent of Le Corbusier’s Maison Jaoul. The scheme took the shape of a quadrangle having a courtyard in the centre symbolizing the social and intellectual centre of the campus. However the problem identified here with this plan was that the centre area was trapped between being too big at the beginning of the ‘concentric expansion’ and being too little at the end of the expansion. Also the initial idea of maintaining a visual consistency in the architectural language used was altered as time went on in accordance to the ‘changing nature and requirements of higher education institutions and the appointment of other architects’ this then meant that the initial clearness of purpose which the first core buildings symbolised were overshadowed by the ‘less visually consistent range of additions’ and arguably could be seen as disadvantageous to the general unity of the scheme, or could be seen as creating the opportunity for outstanding new architecture.

The design of the University of York by architects Robert Matthew, Johnson Marshal and Partners was identified as the ‘Molecular Campus’ originating from ‘the Oxbridge collegiate model, its structural plan established several social nuclei centred around a tripartite grouping of functions’ The scheme aimed to superimpose various activities of the growing institution in similar ways around the ‘mixed –use foci’ Pierce noted that the University of York site was built in a typical English picturesque style which ‘lent itself to the erection of individual pavilions juxtaposed in the landscape’ he argued that this individualised construction method was dissimilar in the different colleges.

The third scheme derived was from Denys Lasdun’s design for the University of East Anglia referred to as the ‘concentrated model’. The academic structure proposed was the most notable aspect of the design strategy wherein ‘the university was to be unitary and arranged around schools of study that will provide the academic and social structure. Lasdun then came up with a building ‘organism’ made up of ‘a linear arrangement or wall of neutral’ teaching facilities with a row of student accommodation opposite them linked by a ‘narrow access route’.

According to Pierce (2001) though the three models were unique to campus planning, he asserted that they were not innovative with regards to urban planning approaches. That they also presented questions which were central to much urban planning theory but that their uniqueness was based on the fact that three independent architects proffered three contrasting design solutions albeit under the same conditions and they were from similar backgrounds. He added that also the unanswered question was that of how much control any individual architect could expect to achieve in the design of such a complicated structure called a university.

Pierce (2001) reiterated that it is evident that the promotion of polytechnics and other colleges to the status of universities led to the fourth generation of universities discussed in section 4.2.9 these new universities then grew to establish the connection between everyday life and the world of academia and research making it a very important aspect of civic life. A network of Higher education Institutions locally based but of a global reach and it was therefore a challenge to the third generation of universities at that time.

4.3.2 The Future of Universities and Higher Education Institutions

The changes in the teaching and learning approach brought about by the establishment of the new universities has also had a corresponding effect and remarkable change in the type of technology used in higher education with major advances in the communication media, such as radio, in the early 1920s and 1930s for mass education; the use of tele-visual communication developed by the Open University and the distance learning education method enhanced by the arrival of the readily accessible network communication through the internet (Pierce 2001). It is thought that the traditional role of the locally based universities and higher education institution campuses would be transformed by the provision of a global education system. Pierce (2001) stated that the idea of a virtual campus replacing the physical one as proffered in 1995 by Professor Bill Mitchell in a book he titled 'City of Bits; Space Place and Infobahn became a reality about five years after its publication indicated that 'in the progression of British university development, from the medieval inception of Oxford and Cambridge to the second age of the expansion of the redbrick universities to the third age of the out-of town' (satellite) campuses of the 1960s and to the fourth of the polytechnic universities which were incorporated as parts of the city's structure, Pierce (2001) thought that 'we were moving towards the virtual campus which would offer the fifth generation of universities.' Pierce (2001) maintained that in all of these progressions the power of architecture at its best had a major part to play in the provision of an environment that would create the virtual campus of the twenty first century.

Other factors that would influence the future delivery of universities and HEI are based on changes, in the students' population statistics with respect to mode of studies, gender ratio, type of courses, disability, ethnicity etc. (HESA, 2010) Fig 4.3a to 4.3c shows statistics from 1965-2004.

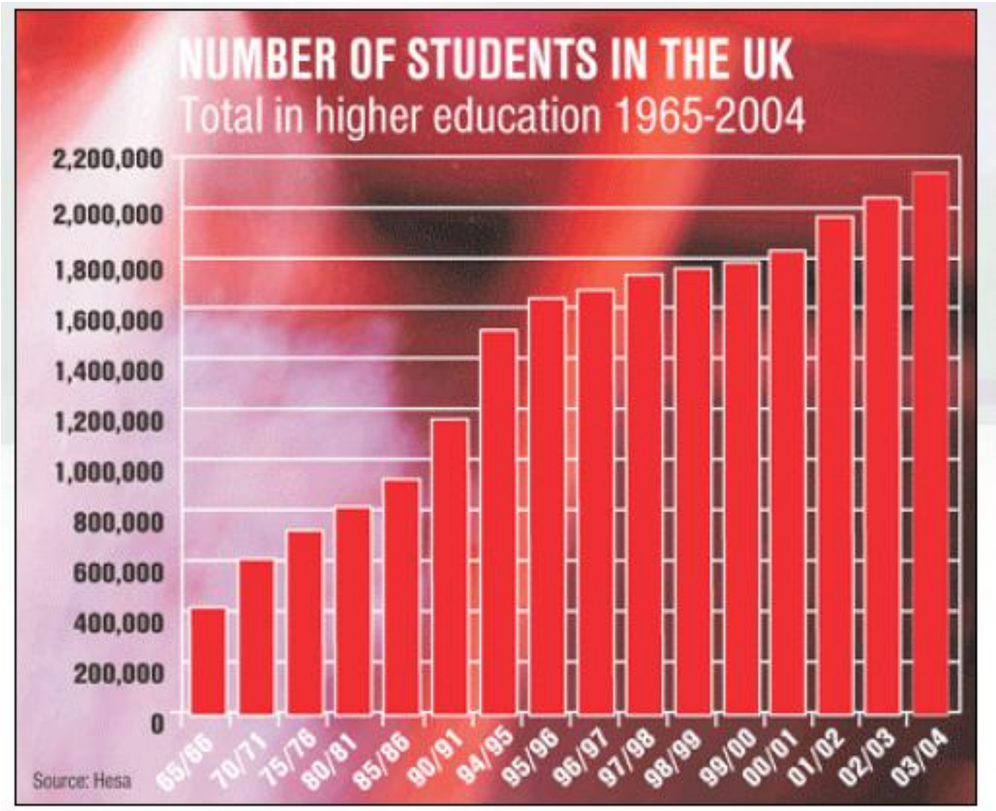


Fig 4.3a Statistics of number of HE students in the UK from 1965-2004
Source: - Higher Education Statistics Agency (Hesa) website.

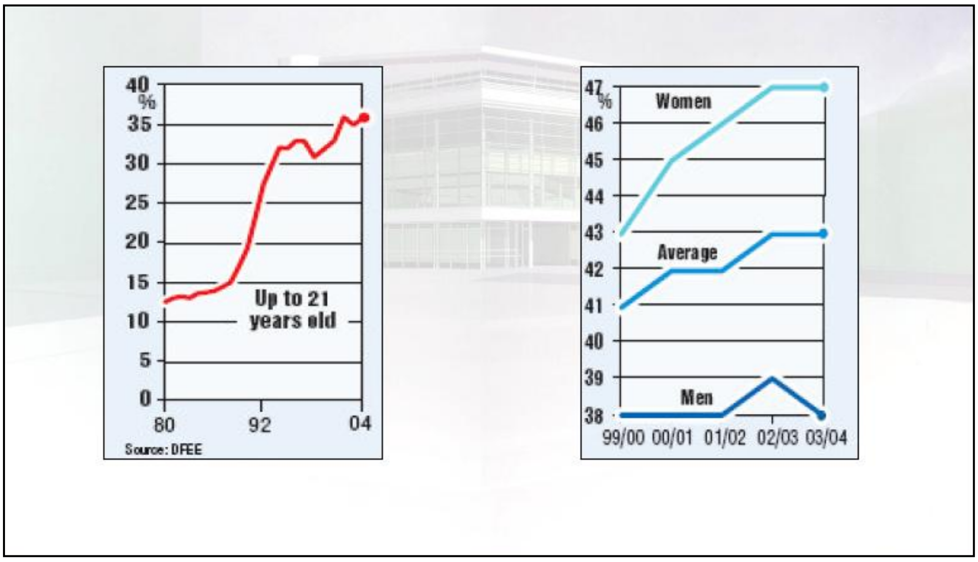


Fig 4.3b Statistics for Age and gender Ratios of Students in HEI 1999-2004

Source: - Higher Education Statistics Agency (Hesa) website.

4.4 UNIVERSITIES AND HIGHER EDUCATION INSTITUTIONS BUILDINGS IN THE TWENTY-FIRST CENTURY

Fig 4.4a University of Reading's ISMA banking research building an example of a Cost model: 21st-century university building:

Source: http://www.building.co.uk/story. Accessed online 15 May 2010

Langdon and Everest (2002) described the building as one which 'combines architectural flair with a practical working environment'.

Fig 4.4b University of East London.

Source: http://www.building.co.uk/story. Accessed online 15 May 2010

Figure 4.4b is a Cost model: 21st-century university building: it was reported that it offered its students 'space and light', by creating a motivating environment and thereby helping to reduce drop-out rates.

The article which by Langdon & Everest (2002) also stated that 'the government wants 50% of 18-30-year-olds to be educated to degree level by 2010, and expected universities to compete in international research markets. They explained that it was therefore imperative to investigate what type of 21st-century University buildings were required to help deliver these goals.

The Article claimed that a great number of universities desired buildings which offered a physical symbolization of academic and social models, therefore the universities tend to be good patrons of architecture. The early 21st century was thought to be included, and institutions were seen to have commissioned some good looking structures using combinations of public and private funding. Also they asserted that the UK higher education sector achieved high performance and excellence albeit within 'a culture of poverty'.

It was observed that the comparatively strong performance was evident through the minimal drop-out rates from courses that were taught, as well as the volume of publications from research activities. Furthermore it noted that this had been done against an environment of rapid growth, **through increased student figures '65% to 2 million since 1989.**

The same view was also expressed by the Department for Innovation University and Skills (DIUS) in their **Postgraduate study: Student Record Analysis** research report 08 16 on the postgraduate study in the UK 2000/01-2005/06 which stated that **the numbers were increasing** such that **between 2000/01 and 2005/06, the figures of postgraduates learning at HEIs in the UK went up by 21.5% from 448,696 in 2000/01 to 545,369 in 2005/06.** Adding that **the greatest increase** at this time had been noted **in the number of non-EU students, which went up by 51,862 (71.4%), in comparison with 36,453 of UK students (10.8%) and 8,358 (21.6%) of other EU students**. The DIUS (2006) report noted that **in 2005/06, about a little lower than a quarter (22.8%) of postgraduate students were resident outside the EU, and one out of eleven (8.6%) were from other EU countries**.

The report also claimed that the bulk of the postgraduate population was lower than a third of that of the undergraduate population, but in with respect to percentage growth, it had gone up higher than the undergraduate population within 2000/01 and 2005/06, due to the increased growth in non-UK resident students amidst the postgraduate group. The report however noted that the increase in the size of postgraduates had however not been stable over that time. Their analysis showed that **between 2003/04 and 2004/05, there had been a 3.2% decrease in the number of new students that were resident in the UK but that this was subsequently followed by a rise again in 2005/06.** The analysis submitted claimed that among other EU postgraduates resident in the UK, the figures increased only slightly between 2004/05 and 2005/06; while simultaneously, the number of new postgraduate student who were non-EU decreased slightly by 0.1%.

Langdon and Everest (2002) observed that research income was also increasing by 70%' and argued that the growth in student numbers had been 'met by a mere 26% increase in floor area, as well as a reduction in funding per student of 37%. Langdon and Everest (2002) expressed the opinion that University estates were subsequently being worked harder than ever before, such that the consideration 'of flexibility and the ability to accommodate change' were becoming vital concerns as novel ideas of teaching and research were being developed.

I. Procurement

Langdon and Everest (2002) claim that procurement of university buildings involved reconciling the objectives of the academic end user with those of the university's estates, business development and finance departments Observing that the end user had 'specific functional and design criteria'; while the estates team would be considering the issues of 'long-term estate management strategies, running costs and the reuse of vacated space; and the finance team would be required to closely monitor capital expenditure. It asserted that detailed assessments of 'need and option appraisals' were vital in achieving a balance between the said 'interest groups' as it believed that 'the success of a university's internal procurement strategy and project management' was vital to the success of the building as was documented in 'the guide, Procurement Guidelines for High Education: Building and Engineering Projects, published by umbrella body Universities UK in 1997' which had been produced to 'encourage a managed, stage-by-stage approach to procurement. It stresses clear project definition, strong project leadership and clearly defined roles, adequate internal resourcing, and the continued ownership of the project by the end user'

In university projects, the achievement of a cost, time and quality balance is particularly difficult.

II. Characteristics of University buildings

Langdon and Everest (2002) stated that universities were 'distinctive and complex communities of academics, researchers, teachers and students who benefit from close interaction and shared access to costly and resource-intensive facilities such as libraries or research laboratories' therefore, buildings commissioned for universities needed to support the work carried out within them while offering opportunities for the individual and group study, thought and interaction that were essential to the university experience for students and staff. According to them, it meant the provision of space that were adequately flexible in order to sustain learning 'based on lectures, group work and individuals or the specialist facilities required in a laboratory, design studio or library'. They also stated that the function of a university building therefore surpassed that of providing work space and that clients had 'recognized the importance of the overall setting of buildings' within their campuses, as well as the significant impact which good-quality architecture could have on the overall environment and the concept of the university as it was believed that 'good-quality buildings' were increasingly important in attracting learners, 'academic staff and research grants'. According to Langdon and Everest (2002) the following factors listed below was why Universities were able to 'commission high-quality buildings'

- *They were largely autonomous and could set their own requirement.*
- *Most university buildings were 'one*-*off commissions that require a carefully considered response to an end user's brief'.*
- *Universities potentially have access to additional funds to supplement central government grants to secure the quality of building they require. These sources include borrowings, third-party funding bodies and private donors.*
- *The brief is typically developed by the end users, in conjunction with the estates and finance team.*
- *As owner–occupiers, universities will consider in detail the impact of the building on the remainder of the estate and on operating costs during the planning stage.*

III. Trends in University Development

According to Langdon and Everest (2002) there were some significant developments in university-based teaching and research that would have an effect on new buildings and the existing estate. These were listed as:

- *Widening participation. Government policy was to provide places for half of 18-30-year-olds by 2010. The introduction of 300,000 new students, a 15% increase, will not only put pressure on existing capacity, but will also encourage changes in course delivery, using group- and screen-based learning that, in particular, will place pressure on general teaching space and learning resource centres.*
- *Multidisciplinary research. Academic research in science and humanities is being undertaken by multidisciplinary teams rather than isolated individuals, requiring buildings to accommodate previously scattered researchers and creating opportunities to raise the institution's profile. Graduate school buildings such as Cambridge University's Centre for Mathematical Sciences are designed to very high standards to attract researchers and funding. A feature of these is the variety of spaces provided to support group and individual working, and the amount of space devoted to encouraging interaction such as cafes and other public areas.*
- *Creative arts. The growth of the new media has led to a similar expansion in the delivery of practice-based arts courses. A high proportion of the teaching of these courses is project-based, which requires specially equipped workshops and studios. This is expensive to build and maintain and is usually too specialised to be used by other disciplines. As science has been given such priority, little funding is available; capital funds to provide modern facilities are very limited.*
- *Student-centred learning. This requires students to use their own initiative to achieve good educational outcomes, primarily through project work, and has become more common as student numbers increase. Although lectures continue to be delivered, tutorials have largely been dropped in favour of group work. Space implications of student-centred learning include requirements for more PCs for online teaching materials, plus space for group and project work.*
- *Information and communications technology. ICT has become increasingly important in higher education as a wider range of source material is delivered online, and universities are expected to prepare students for their future working environments. Although an e-university is being developed, the costs of online*

material are high, and it is unlikely that direct teaching will be replaced by online sources in the near future. The principal problems associated with the increase in use of IT are the costs of bandwidth, installing IT networks in existing buildings and the 100% increase in desk *space for students using PCs rather than conventional research material.*

IV. The Existing University State

'There are 130 higher education institutions in the UK, with an estate of 18 million m2 and a total insured value of £26bn'. Almost 50% of the buildings were built in the 1960s and 1970s and several were nearing the end of their financial and practical life. It was stated that while £4bn had been devoted to 'university infrastructure over the past 10-12 years, much of this has been project-focused, often for the development of scientific research buildings rather than the improvement of the existing estate'. (Langdon and Everest (2002)

- *As per capita revenues have been squeezed, universities have not been able to invest in maintenance and replacement. The latest condition survey available, based on 1999/2000 data, estimates that 36% of the estate in England will require repair or replacement within three years. The total cost of the backlog in UK-wide institutional infrastructure is estimated to be £8bn, of which £4.6bn is related to teaching space rather than research or student accommodation.*
- *The problems associated with the existing estate include:*
- *Constraints on campus development. Many campuses have limited space for expansion, and for some 1960s universities, the potential for listing could further limit development options.*
- *Building condition. Universities have to fund works in connection with legislative change, including Health and Safety requirements and disabled access. Implementing the Disability Discrimination Act, for example, will cost £200m in England alone.*
- *Configuration of space. A significant problem is the need to remodel cellular offices to provide sufficient, appropriate learning and social space to meet the needs of contemporary teaching methods. In more specialist areas such as teaching laboratories for science, languages and IT, reconfiguration is required to deal with larger numbers of students and new technology.*

- *Use of space. Many room-improvement projects are targeted at increasing the use of space, usually used for 20-30% of the year. Contemporary teaching methods result in students using a wide range of spaces for learning as well as conventional classrooms. Refurbishment projects need to support this trend by providing more drop-in space for groups and individuals.*
- *Up-to-date equipment. Graduates need to be familiar with the latest IT and equipment in order to develop the required skills.*
- *Increasing participation. Universities are responding to widening participation and lifelong learning by providing facilities such as crèches that are required by new groups of students.*

V. Funding

Langdon and Everest (2002), believed that in the UK, Universities received majority of their income from the public sector. 'The total annual income of universities and colleges in 1999–2000 totalled £10.5bn, of which 60% came from public funds, either from funding councils, tuition fees or income from research grants and contracts'. The remaining 40% was obtained from private sources as well as research income, fees paid by international students, profits from 'on-campus services and charitable donations.' They also observed that:

- *Most of the public funds are administered by higher education funding councils such as HEFCE in England. Its total budget in 2002/3 is £5.08bn, of which £302m is allocated to capital projects.*
- *Funding for the £4bn of investment in university capital projects in the UK over the past 10-12 years has come from a range of sources, including specific departmental funding for backlog maintenance, poor estates improvement, library development and disabled access.*
- *The two largest capital programs, the JIF and the SRIF, have involved joint funding initiatives by the funding councils, the Office of Science and Technology and the Welcome Trust. This has pumped a total of £1.75bn into scientific research facilities.*
- *Additional capital funds are secured from internal resources, private benefactors and joint ventures with the public and private sector. Typically public sector*

capital investment equates to 25% of total expenditure, although this has risen to 50% during the JIF/SRIF programme.

VI. Sustainability

According to Langdon and Everest (2002), for the past 10 years University clients had been at the forefront of 'commissioning sustainable buildings' and that the motivators behind the uptake of 'green principles' were not only due to running costs, although this was seen to be progressively vital as funding was tightened, but also to the 'enhancement of the reputation of universities and the practical demonstration of sustainability as part of a university education'. Other factors listed were:

- *Common features in new low-energy buildings include:*
- *Shallow floor plates to help natural ventilation*
- *Use of thermal mass, including provision of night cooling with exposed concrete slabs and automatic vents*
- *High levels of insulation and air tightness to control heat loss*
- *Generous floor-to-ceiling heights to help natural ventilation and natural lighting*
- *Use of shading to control direct solar gain*
- *Sophisticated building management systems and use of variable speed drives on mechanical ventilation and cooling systems to minimize energy consumption.*

Langdon and Everest (2002), observed that 'although naturally ventilated university buildings actually utilised only 50% of the energy of typical teaching and learning facilities, design schemes that can function without mechanical systems was not always achievable. It was therefore suggested that in such instances, 'mixed-mode approaches, offering 'ventilation or cooling to internal spaces, or cycling internal mechanical ventilation depending on season and load' could be adopted despite the fact that capital cost premiums were linked with multiple systems installation.

4.5 INADEQUACY OF CURRENT HEI BUILDINGS

From the above review of the history of education and the development of university buildings in particular the development of New Higher Education Institution Buildings, it was noted that there were changes in the structure of academia that then led to alterations from a 'teaching based culture to a student –centred learning environment' which had in turn brought new requirement on the type of resources the universities provided. This then led to changes in the expectation of students from staff and vice-versa as students were encouraged to adopt a more pro-active role of participation in their education to the end that the expectation of students regarding the quality of education has changed.

The review showed that in recent years academic institutions have begun to change their learning environment to suit the changing demands of learners therefore university architects are faced with the challenge of providing aesthetically pleasing, motivational, sustainable and extremely functional environments. However with the background understanding of what this study seeks to achieve, there were certain lapses which were flagged up with respect to the architecture and space design of the university campuses. There were inadequacies in aspects such as Functionality, Aesthetics, Build Impact and Sustainability and some of these have been itemised as follows:-

The un-suitability of the teaching and learning spaces for adoption of recent and emerging technology and technology supported learning requirement

- Lack of flexibility in space design as seen in the design of theatres, lecture halls, libraries etc.
- - Sustainability issues- need for more sustainable development in facilities and design.
- Location based learning facilities- learners are expected to study within the facilities provided
- Inclusive Design Considerations were seen to be lacking such as provision of disabled access for example to buildings.
- Most of the spaces were designed for teacher centred learning rather than student focused.
- Internal Spaces were often not motivational, with several corridors, leading to classrooms, or dead spaces, nooks and dead ends.
- The use of building materials such as precast concrete vaults and brick construction with closed-plan spaces that were often restrictive in use, uninviting, and heavy in massing; Rather than light open plan, multifunctional spaces and construction and materials that invite learners to come in.

These are just a few of the inadequacies which were thought to be largely due to the fact that most of the university buildings were acquired and had to be converted into educational buildings.

4.6 INFLUENCE ON AIM/OBJECTIVES

The reviews done in this chapter has flagged up some issues regarding the inadequacies of the space design and the learning environments of higher education institution buildings as it were.

The changing student expectation as well as technological advancement suggests that there is a need for the facilities provided to change as well. Some of the problems identified were part of the findings from the initial desk studies which led to the development of the research aim and the objectives.

4.7 CHAPTER FOUR SUMMARY

A review of the meaning of education and its history in the nineteenth and twentieth century was discussed. Education was defined as the impartation and preservation of knowledge from generation to generation. The review of the evolution of university building and the higher education institutions from the nineteenth to the twenty-first century was also presented above; review showed that the university era was gradually moving towards a fifth generation of universities. Some of the factors influencing the growth of universities were thought to be increasing student numbers, procurement, funding, sustainability and institutional policies for estate development. However, the review of these aspects has flagged up the question of what the future may offer with respect to the architecture and space design of e-learning focused buildings. Research shows that 'many universities want buildings that provide a physical representation of academic and social ideals, and as a result they tend to be good patrons of architecture' (Langdon and Everest, 2002). It is therefore a current thinking that the power of architecture at its best would play a major part in the delivery of the e-University of the future; A virtual learning environment which is perceived to be the fifth generation of universities.

CHAPTER FIVE- THE DEVELOPMENT OF EDUCATIONAL SYSTEMS

5.1 INTRODUCTION

This chapter focuses on the review of the development of educational systems and the relationship between educational systems in general with particular reference to e-learning space design; also how all these affects the design elements or variables of general teaching and learning spaces such as materials and fittings, layout, aesthetics and some other important factors that determine the final outcome of these spaces as well. For example, the relationship between cultural, social, economic and human factors as it were.

5.2 A REVIEW OF THE DEVELOPMENT OF EDUCATIONAL SYSTEMS

Research (Jarvis, *et al*., 2003) indicated that the different types of learning/education can be classified under various systems of education; two broad traditional categories of educational systems which have generally been in existence since civilisation are the formal and informal systems of education. Under the formal and informal systems, the learning process starts form the primary education system through to the Adult education system (Jarvis, *et al*., 2003). Educational systems are influenced by the advent and uptake of technology use within the educational sector which research indicates has brought about new educational system and methods: **They include the mobile learning, long distance learning, virtual learning, connected learning, face to face learning and e-learning systems**.

5.2.1 The Formal and Informal Education System

I. Formal education: was defined as learning that takes place within a teacher-student relationship, such as in a school system. (Curriculumonline.gov.uk, 2010)

II. Informal learning:

Informal learning has been defined as learning which happens 'through the experience of day-to-day situations (for example, one would learn to look ahead while walking because of the danger inherent in not paying attention to where one is going). It is learning from life, during a meal at table with parents, Play, exploring' (OED, online, May 2010)

5.2.2 Types of Formal and Informal learning systems

I. Primary (or elementary) Education

This is made up of the first five to seven years of formal, structured education, main education In general comprises of six or eight years of education beginning at the age of five or six, although this differs between, and in some cases within, countries. Worldwide, around 70% of primary-age children are enrolled in primary education, and this proportion is rising (UNESCO Report 2008). ‘Under the Education for All programs facilitated by UNESCO, most countries’ have agreed to aim at ‘achieving a universal enrolment in primary education by 2015’, and in many countries, it is compulsory for children to be given primary education. Primary schools in most countries are sometimes ‘subdivided into infant schools and junior schools’ (UNESCO website, online accessed May 2010).

II. Secondary Education

In most Global contemporary educational systems, secondary education is made up of the formal education that occurs during teenage years. It is categorized by the change from the usual mandatory, complete primary education for small children, to the non-compulsory, choice based tertiary, "post-secondary", or "higher" education (e.g., university, vocational school for adults. (Curriculumonline.gov.uk. online, May 2010, online) based on the system, ‘schools for this period, or a part of it, may be called secondary or high schools, gymnasiums, lyceums, middle schools, colleges, or vocational schools’. The exact meaning of any of these words also differs from one system to another. The precise borderline between primary and secondary education also differs from nation to nation and at times within the country also (Merriam, Cafarella and Baumgartner, 2007).

III. Higher Education

Higher education, is also known as ‘tertiary, third stage, or postsecondary education’, (Jarvis, Holford and Griffin, 2003) that it is the not obligatory educational step that comes after the completion of a secondary education (OED, Online 2010) , for example a high school, or secondary school. Tertiary education is generally understood to comprise of undergraduate (tertiary education), postgraduate (graduate school), as well as vocational education and training. The main institutions that provide tertiary education are colleges and universities. These are sometimes jointly, known as ‘tertiary institutions’ and they often award certificates, diplomas or academic degrees to their students on successful completion of the programmes. Higher education usually involves studying towards ‘a degree-level or foundation degree qualification’. Research shows that ‘in most developed countries a good number of the inhabitants (up to 50%) now enter higher education at some point in their lives' (HEA, 2010). Therefore Higher education is very significant to nationwide economies both as a noteworthy business in its own right, and as a source of skilled and knowledgeable workers for the entire economy (HEA, 2005).

IV. Adult Education

The history of Adult education in the United Kingdom (U.K) goes beyond 1870, when compulsory schooling began (Kelly, 1970 in Jarvis, Holford and Griffin, 2003). Adult education had become widespread in several nations, like the United States where the history of Adult education showed similarities (Kett, 1994 in Jarvis et al 2003). During the 20th century, a lot of effort was made in the UK to emphasize the position of adult education. (Jarvis et al, 2003: p2) according to their book, adult education had become accepted in the UK by 1960 as the 1944 Education Act mandated local education authorities to ensure the provision of further education in their communities. It is provided in several different ways, from a series of 'formal class-based learning to self-directed learning and e-learning' (Merriam, Caffarella, and Baumgartner, 2007).

V. Alternative Education

Alternative education, also known as non-traditional education or educational alternative', is a huge term which may be used in referring to all types of education aside from the traditional education (for all age groups and levels of education). This may include not only types of education intended for people having special needs (starting from information on teenage pregnancy to academic disability), but also types of education intended for a universal learners and by utilizing various alternative educational thinking, approach, beliefs, values and processes (alternative education website, accessed online May 2010).

Alternative Education could also come about as a result of the type of education reform very often and are entrenched in a variety of philosophies that are usually essentially varied from those of traditional obligatory education. Some may have prominent 'political, scholarly, or philosophical orientations', while others come about as a result of informal relations of teachers and students discontented with some characteristics of traditional education. These alternatives, which are made up of 'charter schools, alternative schools, independent schools, and home-based learning' differ extensively, but frequently highlight the importance of 'small class size, close relationships between students and teachers, and a sense of community'. (Alternative education website accessed Online, http://www.educationrevolution.org/highered.html#resources, May (2010)

VI. Indigenous Education

It was noted that the addition of indigenous nature of education (methods and content) as an option within the range of 'formal and non-formal education systems' had increasingly began to symbolize a significant feature and a causal factor to the success of those members of indigenous communities who choose to access these systems', as students/learners and as well as teachers/instructors.

Furthermore it was stated that as an educational system the addition of 'indigenous ways of knowing, learning, instructing, teaching and training', had been considered by several critical and postmodern scholars as important for ensuring that students/learners and teachers/instructors (whether indigenous or non-indigenous) are able to benefit from education in a culturally sensitive manner that draws upon, utilizes, promotes and enhances awareness of indigenous traditions (Merriam, et al, 2007).

5.2.3 Technology Driven Educational Systems

There are other educational systems influenced by the advent and uptake of technology use within the educational sector which research indicates has brought about different new educational system and methods (Lou and Alshawi, 2009). They include the mobile learning, long distance learning, virtual learning, connected learning, face to face learning, e-learning systems (Jarvis et al, 2003: p12).

5.3 E-LEARNING AS A TYPE OF EDUCATION SYSTEM

E-learning was thought to provide significant potential for the future (Jarvis et al, 2003, the concept of the learning space is believed to be unrestricted to online learning alone but could take place in other learning spaces; such spaces as listed by Peters, (2002) in Jarvis et al (2003: p12) were: instructional, document, information, communication, collaboration, exploration, multimedia, hypertext, simulation and virtual reality. Savin-Baden (2008) states that there seems to be comparatively little understanding of what the impact of technology spaces were having on the nature of higher education amongst other things. Savin –Baden(2008) stated that for instance, the availability of information to students, the structuring of learning, the development of websites and learning materials, and the changing in patterns of communication were some of the noticeable but perhaps smaller impacts that digital spaces were having on higher education experience for staff and students. She asserts that 'the lack of in-depth longitudinal studies in this area brings about the questions about how enhancing or damaging digital technologies are on student learning'.

Furthermore, Clark & Mayer (2007) defined 'E-learning, as instruction delivered on a computer via internet or CD-ROM' which in their opinion could be 'self-paced or instructor led and includes media in the form of text, streaming video and audio.' They also stated that 'it builds user knowledge to improve organizational functioning.' Also, it is believed that E-learning generally 'refers to training delivered electronically in an organizational setting while JISC, (2006) states that 'Electronic learning or e-learning' is a common phrase, which is used to define 'Internet-based networked computer-enhanced learning.' While this could be as follows:

I. Mobile learning (m-Learning) was defined as a 'specific and always more diffused e-learning' mobile learning involves the use of various mobile telecommunication equipment's, such as cellular phones, Tablet PCs, Laptops, Wireless keyboard/mice, PDA's and Digital Cameras (JISC, 2006). Savin-Baden (2008) defined mobile learning as 'learning for learners on the move'. According to Sharples et al (2005) in Savin-Baden (2008) mobile learning was based on the notion that a reasonable sort of learning took place not only outside the classroom but also that people created sites for learning within their environment. The 'MOBIlearn' group described the uniqueness of mobile learning as follows: it is the learner that is mobile, rather than the technology

- Learning is interwoven with other activities as part of everyday life
- Learning can generate as well as satisfying goals
- Control and management of learning can be distributed
- Mobile learning can both complement and conflict with formal education
- Mobile learning raises deep ethical issues of privacy and ownership

Savin-Baden, (2008) also stated that one of the greatest 'foci' on mobile learning in the early 2000s had been on podcasting and enhanced podcasting where content was recorded in its broadest sense as digital format and then published through a website in order for it to be downloaded unto a mobile device or PC. Savin-Baden (2008) claimed that although the concept of pod casting was still being developed and experimented upon, very little research to explore the pedagogy of mobile learning or how students used their podcasts had been done.

II. Augmented learning/Supported Learning is the result of interaction with an e-learning environment it involves the adaptation of the environment to the needs of individuals so that the context-driven instruction can be dynamically tailored to the learner's natural environment. These may include text, images, and video, audio (music and voice). By personalizing instruction, augmented learning has been shown to improve learning performance for a lifetime. It involves the use of assistive technologies, accessible USB ports, Audio-Visual prompts, Video recording facilities, and Plasma screen information points (JISC, 2006).

III. Multimedia Learning/Visual and Interactive learning

According to research, multimedia learning is where learners utilize multimedia learning environments (Mayer 2001). 'This type of learning relies on dual-coding theory (Paivio 1971,; 1986; Clark and Paivio, 1991). It involves the use of Video conferencing, video streaming, Image protection, interactive white boards, and voting devices (JISC, 2006). Savin-Baden (2008) defined virtual learning environments (VLE) as a set of learning and teaching tools, which involved; online technology that was designed to improve students' learning experience, such as Blackboard and WebCT.

IV) Online Learning/Connected Learning was used to differentiate courses delivered via the internet in educational settings. It involves the use of wired computing, wireless networks, wireless-enabled laptops/tablet PCs, internet enabled PDAs, and mobile phones (JISC, 2007).

5.3.1 E-Learning and its Benefits

Research indicates that E-Learning can be beneficial to the organization and individuals involved (Lou, and Alshawi, 2009) as well as to tutors and learners (JISC, 2008; Savin-Baden, 2008; Ramsden, 2005; CABE, 2006; HEFCE, 2005 and JISC, 2006).

Tangible benefits of e-learning based on 37 Case studies done by JISC (2008) in the UK focused on the following areas:

1. **Cost Savings/Resource Efficiency,**
2. **Recruitment and Retention,**

3. **Skills and Employability,**
4. **Student Achievement and**
5. **Inclusion**

The types of tangible benefits evidenced by the studies were in areas such as:

- Effects on learning (e.g. context, style, insight and reflective practice)
- Effect on exam results
- Effect on student personal development (e.g. skills, employability, confidence)
- Student satisfaction with e-learning (e.g. effect on motivation, attendance and enjoyment, as shown in national survey, institutional survey, module evaluation, focus groups, or other)
- Innovation in teaching, learning and assessment (e.g. stimulus to creative approaches)
- Influence on educational research
- Staff satisfaction with e-learning
- Effect on staff personal development (e.g. skills, employability, confidence)
- Influence on recruitment (students or staff; e.g. through greater accessibility; opening up new markets)
- Influence on retention (e.g. students or staff)
- Influence on policy (e.g. institutional, faculty/school, departmental, or other extra-institutional body)
- Effect on resources (e.g. effect on cost of delivery, time, applying full economic costing to teaching and learning)
- Modifications to learning spaces (e.g. libraries, wireless networks, informal learning spaces)
- Effect on management of learning assets (e.g. institutional IP, repositories)
- Effect on a social justice agenda (e.g. widening participation, provision of space for consideration of differing or challenging perspectives)

Some of the key factors responsible for development of e-learning approaches were also said to be **'increasing student numbers** – recruitment and retention of larger numbers of more heterogeneous students (strengthening social justice and accessibility), 'meeting the **'new geography' of education – staff and students were physically and socially**

distributed' and preferred to pace their participation according to their personal circumstances as **such flexibility in 'time and place' was essential**.

In addition to those listed above, some other perceived benefits are discussed hereunder:

I. Improved performance: A 12-year meta-analysis of research by the U.S. Department of Education found that higher education students in online learning generally performed better than those in face-to-face courses (Means, Toyama, Murphy, Bakia and Jones, 2009).

II. Increased access: It is believed that tutors of the highest competence level can distribute their knowledge across borders; thereby enabling learners participate in courses across physical, political, and economic barriers (DeLong, 1997; in Evans and Nation, 2000). It also suggests that distinguished experts have 'the opportunity of making information available internationally,' to interested persons at minimum costs. A good example is the 'MIT Open Course Ware program' this has made 'substantial portions of the university's curriculum and lectures available for free online'.

III. Convenience and flexibility to learners: Fox and Herreman (2000) in Allan and Nation (2000) explained that in many situations, e-learning was 'self-paced' and that the learning materials were made available 24x7. So that the learners are not restricted to an exact day/time in order to physically attend courses. In addition, learners can also break learning periods at their own convenience. Furthermore, 'high technology is not a necessary for all online courses.' As simple access to the internet, 'audio and video potential are the only common requirements (Kerkman, 2004). Based on the technology used, learners could start their courses while at work and complete them when they arrive home on a different computer.

IV. To develop the skills and competencies required in the 21st century, 'particularly to ensure that learners have the digital literacy skills required in their discipline, profession or career' Bates (2009) states that a major recommendation for e-learning was due to the fact that it created the chance for 'learners to develop essential skills for knowledge-based workers by embedding the use of information and communications technologies within the curriculum.' Bates (2009) also argued 'that using e-learning in this way has major implications for course design and the assessment of learners.'

Furthermore, Bates (2009) noted that benefits of 'computer-based' learning compared to the traditional classroom learning system included the capability to:

- *Pay less per credit hour*
- *Reduce overall training time*
- *Spread training out over extended periods of time (even months)*
- *Bookmark progress (computer remembering where the student left off so they can resume the courses from there)*
- *Remain in one location (e.g., home, office, airport, coffee shop, etc.) with no need to travel (also reduces the cost of transportation to physical classrooms and benefits environment).*
- *Participate in class activities when convenient (not tied to class meeting times)*
- *Access public content such as webcasts or other course content*
- *-Access courses from a variety of locations*

5.3.2 E-learning and its Impact on the Market

According to the European Commission (EC, 2000), the Communication from the Commission: E-Learning - Designing "Tejas at Niit" tomorrow's education in Brussels, 'the worldwide e-learning industry is estimated to be worth over thirty-eight (38) billion Euros' based on conservative estimates, however, within the European Union 'only about 20% of e-learning products were produced within the common market.' Nagy (2005) stated that 'developments in internet and multimedia technologies' were considered to be the general enablers of e-learning, with consulting, content, technologies, services and support being identified as the five key sectors of the e-learning industry.'

5.3.3 E-Learning and its Impact on Higher Education

Research indicates that as at '2006, 3.5 million students were participating in on-line learning at institutions of higher education in the United States (Sloan consortium, 2010). According to the Sloan Foundation reports, by Allen and Seaman (2008); Allen and Seaman (2003) say that there had been an increase of approximately between 12-14 per cent per annum averagely on enrolments for entirely online learning over the 'five years 2004-2009 in the US post-secondary system', weigh against an average of roughly 2 per cent increase per annum in enrolments in general. Allen and Seamen (2009) 'claim that almost a quarter of all students in post-secondary education' were taking completely online courses in 2008, and that 'a report by Ambient Insight Research (AIR, 2009) proposed that in 2009, 44 per cent of post-secondary students in the USA were taking some or all of their courses online, and projected that this figure would rise to 81 per cent by 2014'. JISC

(2005) states that this therefore indicates that e-learning was moving quickly from the edges to becoming a principal form of post-secondary education, within the USA at least.

Several 'higher education, for-profit institutions,' now provides on-line lessons (Evan and Nation, 2000). While comparatively, 'only about half of private, non-profit schools provided them.' The Sloan report, which was compiled from a poll of academic leaders, reported that students usually appeared to be slightly as satisfied with their on-line studies as they were with traditional classes, and that 'private institutions' could become more 'drawn in' with on-line presentations as the cost of organizing such schemes reduced. It also emphasizes that staff that had been satisfactorily trained ought to also be paid to work with students on-line. Furthermore, it argued that these staff members were required to understand the content area, as well as adequately trained in the use of the IT. 'Online education is rapidly increasing, and online doctoral programs have even developed at leading research universities' (Hebert, 2007).

5.3.4 The Moodle Technology as a Forum for E-Learning:

Moodle is an 'Open Source Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE)'. Review shows that it had become very accepted among academics and instructors around the world as a tool for developing 'online dynamic web sites for their students'. In order for Moodle to function, it needs to be installed on a web server, either on a personally owned computer or on one at a web hosting organisation (www.moodle.org. accessed online 18 May 2010).

Moodle defined:

The goal of the Moodle project is basically that of providing educators the most appropriate tools 'to manage and promote learning' however, there were many ways to use Moodle:

- Moodle has features that enable it to scale to 'very large deployments and hundreds of thousands of students, yet it can also be used for a primary school or an education hobbyist'.
- Several institutions use it as their platform to conduct fully online courses, while some use it simply to augment face-to-face courses (known as blended learning).

  Several users of Moodle also like to use the activity modules (such as forums, databases and wikis) to construct richly collaborative communities of learning around their subject matter (in the social constructionist tradition), while others use Moodle as a way to deliver content to students (such as standard SCORM packages) and assess learning using assignments or quizzes (www.moodle.org. accessed online 18 May 2010).

5.3.5 E-learning Communication Technologies

Communication technologies were basically grouped as asynchronous or synchronous.

I. Asynchronous activities use technologies such as blogs, wikis, and discussion boards. The idea being that, participants might exchange ideas or information without depending on other participants' (Mayadas, 1997) involvement at the same time. Electronic mail (Email) is also asynchronous, because mail can be sent or received without having both the participants' involved at the same time.

II. Synchronous activities involve the exchange of ideas and information with one or more participants simultaneously. A face to face discussion is an example of synchronous communications. Synchronous activities occur with all participants joining in at once, as with an online chat session or a virtual classroom or meeting. Virtual classrooms and meetings can often use a mix of communication technologies (Wu, Bieber, and Hiltz, 2008).

In many models, the writing community and the communication channels relate with the E-learning and the M-learning communities. Both the communities provide a general overview of the basic learning models and the activities required for the participants to join the learning sessions across the virtual classroom or even across standard classrooms enabled by technology. Many activities, essential for the learners in these environments, require frequent chat sessions in the form of virtual classrooms and/or blog meetings. Lately context-aware ubiquitous technology has been providing an innovative way for written and oral communications by using a mobile device with sensors and RFID readers and tags (Liu and Hwang, 2009).

5.4 THE IMPACT OF E-LEARNING TECHNOLOGY ON SPACE DESIGN ELEMENTS IN HEI

The need for research into the impact of space design on the learner experience cannot be overemphasised. JISC, (Anon, JISC website accessed 16.05.2010) states that there was 'a new emphasis on student perspectives' which is apparent in schemes like the 'National Student Survey' the 'Committee of Inquiry into the Changing Student Experience,' 'student juries' and Department for Innovation, Universities & Skills' (DIUS) 'Debate on the Future for Higher Education'.

JISC (2010) states that it is leading the way in carrying out investigations into 'students' changing expectations and developing tools and resources to transform the learning experience to meet students' needs. Their work is to facilitate universities and colleges in the application of digital technologies in order to handle challenges 'such as retention, progression, graduate employability, diversity and widening participation,' as it was thought that this will in-turn provide students with the most excellent chances possible everywhere and in whichever way they learn (JISC, 2010).

The concern here is how the adoption of these new technologies will impact on the design of spaces within HEI as discussed in the section below.

5.4.1 Factors That Affect E-Learning and Space Design

A review of recent report for JISC, 'The Design and Management of Open-Plan Technology-Rich Learning and Teaching Spaces' by Watson, Anderson and Strachan-Davis (2007) revealed how some factors affected the design of technology rich learning spaces. These were:

I. Social,
II. Economic and
III. Cultural
IV. Human factors

The report by Watson, et-al (2007) claimed that good design and effective management were vital to the success of projects (either new-build or refurbishment). The report noted that much was at stake for directors of estates, project managers, academic and library staff embarking on a large capital project (HEFCE, 2005) because such projects had the ability to influence the future direction of learning and teaching in an institution.

It was noted that JISC had been 'helping institutions develop physical spaces that anticipate the pervasive use of technology in learning and teaching, enable innovative, learner-centred pedagogies and inspire and motivate wider participation in learning' since 2006. And those JISC resources were made available to provide support every step of the way towards a successful project which includes the process of identifying the vision for 'technology-enhanced learning spaces to exploring the processes behind successful outcomes'. Their newest work in this regard was that based on 'the design and management issues associated with open-plan spaces and video case studies of the impact on practice and culture of five technology-rich new-build and refurbishment projects'. To which end they had put together the following guides.

After the Report titled: **Designing Spaces for Effective Learning (2006) – an introductory guide to designing technology-rich space**, the following emerged:

I. Implementing and managing new designs- Five video case studies exploring the implementation of technology-based designs for individual spaces and whole campuses *(Case Studies of 21st-Century Learning and Teaching (2007)* as well as a report on the operation of open-plan spaces, with case studies and guidelines for senior managers *(The Design and Management of Open-Plan Technology - Rich Learning and Teaching Spaces in Further and Higher Education in the UK, 2007).*

II. Guidance for each step on the journey- An applied info Kit following the life cycle of a project from vision to post occupancy, with an image gallery, virtual campus tour and links to related resources (JISC, 2007).
The report and associated case studies explored 'strategies for containment of noise, management of environmental controls, maintenance issues and user behaviour' (Watson, L. et al, 2007).

Background- The study reported that useful data for their study were collected from over 40 institutions through a questionnaire, 'telephone interviews and site visits, supported by desk studies'.

The Overall findings- Watson, et-al (2007) submitted that 'growth in the power and availability of technology has, had a considerable impact on the physical estate.' With increasing recognition of the social origins of learning, many institutions were now developing large-scale learning centres equipped with IT in addition to libraries – the earliest known examples of open-plan learning spaces.
Such spaces are often known as social or information commons. Typically, they:

- were open plan, exceeding 200 sq. m in area
- Support both private study and group project work by means of zones or partitioned areas

- May be used by members of staff and the local community as well as enrolled learners
- Primarily offer access to digital resources via institutionally owned technologies, but increasingly make provision for learners' personal devices

Also the report explained 'that the evidence indicates a mixed degree of success in the design and operation of this type of space. In some cases, open-plan spaces have been in operation for some time, resulting in modifications, such as the enclosure of parts of the space, which have had a detrimental effect on temperature and air quality'.

The report differentiated between 'strategic, design and operational issues.'

Strategic:

- *The format of a new space and its approach to technology should reflect the strategic intent of the institution*
- *All involved in the design, management and use of the space – from senior managers and subject faculties to IT services, estates and facilities teams – need to fully understand the strategic objectives of the new space*
- *Users also need to be informed about the project's development and to be consulted on its operation*
- *Failure to successfully manage users' expectations of the space will create a vacuum in which subjective, ill-informed opinions may take hold*
- *A marked increase in student ownership of technology indicates a likely shift towards a service-based rather than a hardware and systems-based model*

Design:

- *Learning is an activity with many variables. Learners equally hold varying opinions about environmental features such as temperature, ventilation and noise. The most successful designs include a range of microenvironments to suit individual needs and preferences*
- *Excessive heat, poor ventilation and restricted circulation of air are nonetheless notable problems with this type of space and are exacerbated by changes to the original open-plan design. Systems of heating, ventilation and air conditioning should be designed with the likelihood of later changes in mind, since passive or single-mode systems – often promoted for reasons of sustainability – may compromise the flexibility and performance of the space over time*

- *Didactic teaching in open-plan spaces is proving unsatisfactory and will increase the complexity of the managerial demands made by the space. However, enclosure of small areas for teaching rooms will restrict airflow through the space*
- *The 'oomph factor' of iconic designs has a motivational impact on learners, but a balance must be struck between innovative design, user satisfaction and operational effectiveness*

Operational:

- *Good ventilation, temperature and noise control are basic user requirements. Inability to control these features causes frustration and tampering with controls. Localised controls – including open-able windows – increase user satisfaction with open-plan spaces*
- *Active measures to develop a culture of self-regulation, such as user guidelines, help to minimise problems of litter and unacceptable noise levels. Cues for appropriate behaviour, such as graphics, sound and light-touch policing – including the presence of learning guides, assistants and facilities staff – can prove helpful in establishing different types of behaviour in different parts of the space*
- *Intensively used spaces require increased budget allocation for cleaning. Localised maintenance teams ensure a more prompt, flexible response and are more effective in maintaining standards than centralised facilities*

The major proposals from the study were presented under the following groupings.

CaseStudy1:-**Establishing A Culture:**
The study stated that 'The Information Commons at the University of Sheffield was a social and collaborative learning environment opened in 2007 to provide 1300 learning spaces in addition to those available in the university library'. The new facility had no fixed patterns of use. Rules for learners had been put in place to support positive attitudes –'litter, noise and prolonged ownership of computer spaces were initially recorded as problems'. Students had begun to claim 'ownership and responsibility for the space by establishing their own Information Commons group on Face book'.

Casestudy2:-Refurbishing Existing Space:

This study was conducted on a 'low-cost project, Open3 at Loughborough University'. It was a dedicated refurbished space within the existing university library. Different sorts of use were assigned to the various floors of the building to circumvent disturbance. Food and drink were allowed in the group working spaces adjacent to the café, but were banned somewhere else. The vertical zoning on various floors had enabled such rules to be set up with comparative ease so that the need for monitoring had reduced over time.

Case study 3- Modifications over time:

The Information Terraces at the David Goldman Informatics Centre, University of Sunderland, was one of the oldest open-plan, technology-rich spaces in the UK. Some of the open space had been enclosed for offices and specialist IT functions.

The building had 'centralised temperature and humidity controls' and was dynamically ventilated. In spite of this, enclosure of some of the space had made temperature control less functional, such that upper levels experienced hotter conditions.

Conclusion and observations:

The report concludes that design and management issues cannot be separated, since the ideal solution for many problems was to recognise the potential for disruption in the initial design. Much was requested of these spaces, and the 'greater their complexity, the greater the management demands will be' – these were spaces which had to be 'flexible, blended, variable, accessible, inclusive and exciting, but at the same time utterly practical'.

New measures of success are needed to test how such spaces support different user activities. Existing measures of success focus too narrowly on recording footfall and use of resources to fully evaluate the role of this type of space in effective learning.

Guidelines for managers:

The report states that over 30 guidelines for managers have emerged from the study, ranging from strategic planning to operational issues. Many relate to the tension between the requirement to preserve flexibility and the pressure to enclose parts of the space:

'The definition of building zones can involve walls, partitions, changes in materials and use of graphics. Each will have a greater or lesser effect on flexibility and modification of acoustic or climatic internal environment. Be clear on the degree of change that is anticipated and the degree of fixity that is therefore desirable'.

Case Studies of 21st Century Learning and Teaching

Five video case studies were launched at the 2007 JISC Conference to complement the 2006 JISC publication, Designing Spaces for Effective Learning. These explore how five UK institutions and departments achieved their goals and are available online with transcripts for use with a screen reader: a brief on these case studies and future implications have been included in Appendix G the summary is presented here.

Summary of 21^{st} Century Learning and Teaching Case Studies

The first case study dealt with the changing culture; the second was about 'a social and collaborative learning space, the third case study was about A technology rich space for inquiry-based learning; the fourth case study was about a technology rich science centre; and the fifth case study was about A campus for 21^{st} century. The report implied that the physical campus will remain at the core of educational provision for the foreseeable future, but that many spaces will not look or function as they have done in the past – nor should they. This is almost in contrast to Pierce (2001) assertion that the future of the higher education institutions would be the virtual campus.

5.4.2 Towards Achieving Sustainable E-Learning Space Design in HEI

WBDG (2010) noted that building construction and operation had far reaching 'direct and indirect impacts on the environment', as it was believed that buildings consumed '*resources such as energy, water and raw materials, generate waste (occupant, construction and demolition) and emit potentially harmful atmospheric emissions. Building owners, designers and builders face a unique challenge to meet demands for new and renovated facilities that are 'accessible', 'secure', 'healthy', and 'productive' while minimizing their impact on the environment.*

The article noted that 'with consideration for the on-going economic challenges, retrofitting an existing building could be more cost effective than constructing a new facility.' That costs from operational and environmental impacts could be decreased by 'designing major renovations and retrofits for existing buildings' which embraced sustainable schemes and, as it was thought that this could increase building flexibility as well.

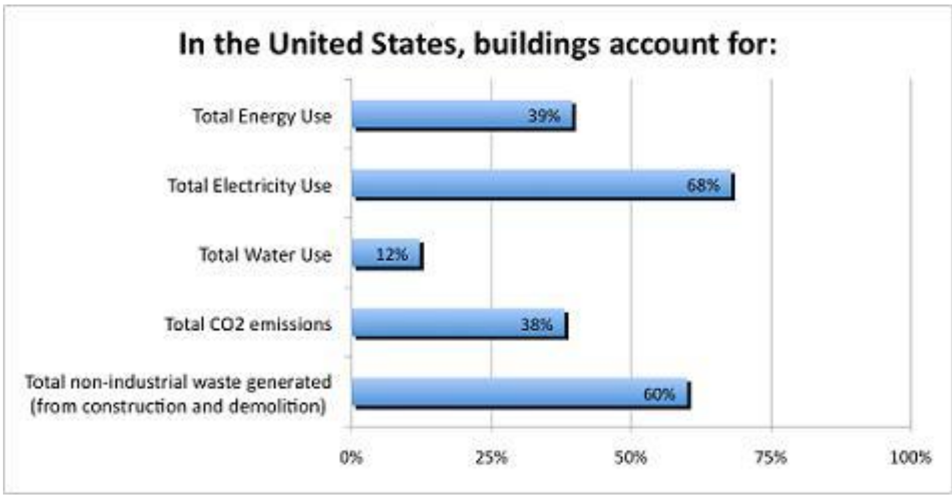


Figure 5.1 United States Building Energy Consumption:
Source: EPA, 2004

WBDG (2010) concluded that the current solution to the challenge 'called for an 'integrated, synergistic approach' that involved all phases of the facility life cycle. And that the approach, was often called "sustainable design," which 'supports an increased commitment to environmental servitude and preservation,' leading to an 'optimal balance of cost, environmental, societal, and human benefits while meeting the mission and function of the intended facility or infrastructure'. Hence this approach may also be the possible solution to the factors that affect the effective design of the learning space as listed in section 5.4.1.

The article also affirmed that the key purposes of sustainable design were to guide against depletion of resource 'energy, water, and raw materials; prevent environmental degradation caused by facilities and infrastructure throughout their life cycle; and create built environments that are 'lovable, comfortable, safe, and productive'.

5.5 CHAPTER FIVE SUMMARY

This chapter presented the findings on the development of different educational systems from the traditional form of education to the technology driven systems and the relationship between educational systems in general with particular reference to e-learning systems; also how all these affects the design elements or variables of general teaching and learning spaces such as materials and fittings, layout, aesthetics and some other important factors that determine the final outcome of these spaces as well. For example, the relationship between cultural, social, economic and human factors as it were. It was apparent that the relationship between space design, technology and education was constantly evolving as shown by the reviews presented here and therefore there was a corresponding need to constantly engage in proffering solutions to the issues with respect to users and the environment as well.

JISC (2006) believed that, the physical learning environment would remain at the core of educational provision for the foreseeable future, but that many spaces will not look or function as they have done in the past – nor should they. As understanding increases of the different ways by which people learn in a digital age, so physical space design in educational institutions will continue to evolve'. This was almost in contrast to Pierce (2001) assertion that the future of the higher education institutions would be the virtual campus in the 21st century.

The approach of incorporating sustainable values into e-learning space design was considered as a likely solution to the issues of factors that affected the effective design of E-Learning Spaces in HEI.

CHAPTER SIX: METHODOLOGY AND FIELDWORK

Section Two focuses on the research methodology developed and the subsequent field work carried out. It presents the primary data from some survey outcomes and case studies conducted. It comprises of **chapters six** to eight**.**

6.0 INTRODUCTION

Chapter Six is divided into two parts, the first is about the research methodology developed and the second is about the field work done. Part one is covered in sections 6.2 - 6.8 and explains the why? what? and how? of the research method chosen; looking at the choice of the mixed methods research approach that was used. Part two, covered in sections 6.9 – 6.10, is dedicated to the field work carried out in the research. It presents the development of the tools used; criteria for case study selection, the pilot studies, questionnaire survey and the structured interviews. How all these were then used in the research along with the outcome of the e-learning forums done earlier at the onset of the research and how the forums helped to inform the research direction into the investigation of case studies and interviews done in the study of e-learning spaces design in HEI campuses.

PART 1- METHODOLOGY

According to Wolcott (2001), *every research is founded on 'observational data, which might be overlooked by persons who insist on placing emphasis on the dissimilarity between qualitative and quantitative approaches;* he argued that *placing the two at opposite ends creates a huge disadvantage as this detracts from the advantages both has and could offer to each other.* He further explained that "*most qualitative researchers would benefit by paying closer attention to whatever warrants being counted and measured; most qualifiers could lighten-up to reveal highly personal aspects about themselves that strongly influence their professional practice. We all number our pages; we all make hopelessly subjective decisions, in selecting topics we research, regardless of how systematically some researchers precede beyond that"*

6.1 BACKGROUND TO THE RESEARCH METHODOLOGY

The strategy used was a fact finding mixed method approach founded on theories obtained from literature reviews, desk studies and forums, site based analysis, interviews and case study investigations along with interpretation of analysis of data from the questionnaire survey as well as descriptive analysis and some explanatory research approach. This first section of chapter six focused the research approach and methodology and how it was developed. It explains how the development process evolved based on consideration of various research approaches, and strategies. It begins with the investigation of the suitability of the qualitative or quantitative analysis methods to the research enquiry. These research approaches are defined hereunder.

As the aim of this study was to develop a novel methodology for e-learning space design in higher education institution campuses. This implied that an investigation of a human problem would be essential as well as the assessment of the proposed hypothesis and theories which involved numeric evaluations and statistical analysis in order to determine their accuracy. Furthermore, Rudestam and Newton (2001) claim that statistical processes were useful for studying the relationships between prototypes and articulating these with numeric figures. They also stated that these could either be descriptive statistics or inferential whereby probabilistic arguments were utilised in order to generalise results from samples. This chapter therefore describes the research methodology adopted; their justification and an understanding of the different approaches used for the data gathering and analysis carried out throughout the study and the application in the field work that was done.

Overview of Research Methodology

Just to recapitulate the Research Method adopted for this study into e-learning space design was based on a philosophical approach that combines inductive and grounded theory methods. “Induction” was defined as “being a process of reasoning, in which observations are made and then used to build general statements and hypothesis; which may then be tested.” and “in grounded theory, data are systematically gathered and analysed, and then used to generate a theory”. The steps (of grounded theory) involved the use of questionnaire survey, interviews and case study/ site based analysis as well as desk studies which were later analysed by categorisation/grouping of data and systematic coding. Other academics that have used this method to obtain data in a recent and similar type of research for example were Clements-Croome et al (2010) in a study on ‘Designing Intelligent Schools’ in which ‘evidence based research and practice’ (involving interviews, case studies/site based analysis) was used to provide recommendations for ‘designing and managing intelligent schools’ which would be ‘responsive to user needs’.

Consideration for A Strong Research Ethical Framework

In the course of this study, it had been a matter of importance to ensure that all ethical standards, consents and approvals were obtained at every point where it was required. However, it was also thought that a statement about the position and perception of the researcher in this study would be useful in building an ethical research framework. The researcher agrees with the view point of Doucet and Mauthner (2002:134) in Cousin (2009:190) described as "knowing responsibility" in trying to adopt a 'strong ethical framework. Their opinion as stated expressed

> " *that a wide and robust concept of reflexivity should include reflecting on and being accountable about personal, interpersonal, institutional, pragmatic, emotional, theoretical, epistemological and ontological influences on our research, and specifically about our data analysis and processes"*.

Cousin (2009) noted that there "were at least two good reasons for having a strong ethical framework for a research project" she explained that the first was "a protective function" for the researcher and for what was being researched as well; and the second reason was that "it is facilitative; an ethical orientation supports the thoughtful conduct of the research process and the eventual credibility of the research report".

Shank (2002:97 in Cousin (2009:17) stated simply that " a good researcher is an ethical researcher" one that understands that "methods and values are entwined" (Cousin, 2009) such that whatever method of investigation used would necessitate the self-evident respect for the persons within its range (Cousin 2009) this comes down to four crucial considerations which were named by Shank (2002:97) in Cousin (2009:17): "do no harm," to "be open" to " be honest" and to "be careful".

Therefore as the researcher is someone with a background in architecture/construction project management, undertaking postgraduate studies within the built environment the researcher's thought on the design of a good technology supported learning environment are hinged on the expectation that the spaces should provide an enjoyable teaching and learning experience for the users irrespective of the facilities and technology provided. More so the researcher believes that the users ought to be involved in the design decisions (from the onset) of any space design project meant for their benefit. It is expected that the design of the spaces be done in a manner that enhances the technology input and overall learning outcome.

While the researcher expects to be objective in the approach to this research inquiry, the researcher acknowledges the likelihood of making judgements from an architect/project-manager and user's perspective but the researcher would and have endeavoured to always consider the strengths of the arguments put forward as well as the research focus and its aim and objectives. As Cousin (2009) writes, the following have been considered and adopted:-

- *Reflexivity* – it was *'recognized that the type of data was likely to be influenced through the way the questions were set out, the method and research tools adopted and how the data was interpreted.*' Notwithstanding as Cousin (2009) advised, the researcher endeavoured*" to be reflexive about this issues in order to" recognize the researcher's position in the research.* Therefore it was *"preferred to present the data in the passive form as normally associated with scientific research i.e. the third person."*
- *Trustworthiness*- was also considered, to this end all interviews, discussions and case study reports were sent back to the contacts and participants, in order for them to check and correct the drafts; with the aim of ensuring the credibility of my findings and as much as possible eliminate the tendency from inaccurate assumptions on my part and the possibility of misrepresentation of the evidence presented.
- *Intellectually informed*- the researcher endeavoured *to "develop a strong and convincing engagement with adequate literature to underpin the theoretical claims made."* This has been achieved through the thorough review of literature at the beginning and during the study.
- *Corroboration*- the researcher endeavoured to *"share research findings and analysis with research subjects and/other researchers"* in academia as well as industry through conferences, poster competitions, seminars and journal papers
- *Social responsibility*- the researcher endeavoured to handle "*issues of equity, quality, academic freedom, and respect for other scholars and ensured that the rights, dignity and confidentiality of the research participants were protected."*

The above therefore were useful as a background for the investigations carried out and reported hereunder.

6.1.1 Understanding Quantitative Research

Referring to Naoum (2003), the quantitative research approach is objective in nature as such this objectivity is an underlying concept that was a focus throughout the research process as the aim of the study was considered to be objective in nature as well. Naoum (2003) states that the selection of the type of research strategy is determined by the 'purpose of the study and the type and availability of information that is required' while Rudestam and Newton (2001) observed that this method should be 'sufficiently rigorous and appropriate to the research question' so as to 'successfully evaluate a completed study irrespective of the study being conceptually and or theoretically grounded; hence the adoption of a particular research strategy will affect the final form of the dissertation'. Creswell (2003, 1994) also defined quantitative research as an enquiry or 'investigation into a common or "human problem", by carrying out an assessment of hypothesis or a theory made up of variables, that are evaluated with numbers and analysed with statistical methods in order to determine the accuracy of the hypothesis or theory'.

Quantitative research involves the use of research methods such as questionnaires, interviews, observation and documents which generate quantitative data (Denscombe, 2007). Quantitative data are not abstract but "hard and reliable measurements of tangible countable, sensate features of the world" (Bouma and Atkinson, (1995) in Naoum, 2003). Bell (2005) stated that quantitative research involves the collection of facts and study of relationships between one set of facts and another, and that quantitative researchers use techniques which are 'likely to produce quantified and if possible, generalizable conclusions.' These definitions therefore agree with the view of Naoum (2003), Creswell (2003, 1994) and Rudestam and Newton (2001) as they imply that the quantitative research approach is suitable for finding and collecting facts about a study.

Agreeing with the above arguments, the research adopted a fact-finding approach, which aimed to examine the hypothesis and theories that had been developed from the early stages of the research endeavour by gathering facts using a mixed method study approach, looking at the relationships between the factors that determine this research which were the people, the design of the e-learning environment and the technology as well as developing a research strategy with achievable objectives that enabled the researcher test the underlying theory/hypothesis developed. To this end, documentation of focus group discussions and desk studies were the initial precursor that informed the research direction; subsequently, pilot studies were done then site based analysis /case studies, interviews and three sets of questionnaire surveys were administered to a predetermined number of participants from three categories. The data obtained were therefore analysed using content analysis and thematic analysis as well as some descriptive statistical analysis that were presented descriptively and in statistical quantities.

Below is a brief discussion on the benefits, disadvantages and types of quantitative research that were considered during this study.

6.1.1.1. Benefits of Quantitative Research

Denscombe (2007) observed that some advantages of quantitative analysis were that they provide answers to closed-ended questions obtained from questionnaire; they helped with content analysis of transcripts obtained from interviews; they were seen to be are suitable for measurements of experiments, or observation schedule used with events and also they provided official statistics obtained from documents. Also quantitative analysis were said to be beneficial because they are scientific and quantitative data allows for various forms of statistical methods of analyses to be applied; derived from principles of mathematics and probability. Other benefits noted by Denscombe (2007) were that it brings about confidence as the 'statistical tests of significance' provides added credibility to the researcher's data interpretation and findings; the quantitative analysis process gives foundation for the authentic measurement, description and analysis of quantities which can be checked by anyone; it also allows for a large amount of data to be analysed relatively faster; the mode of presentation of quantitative data is considerably a more effective and succinct way i.e. charts and table.

6.1.1.2. Disadvantages of Quantitative Research

The main disadvantages highlighted were that of the data quality which were said to be only as good as the data collection method used; to address this concern the researcher adopted a mixed method approach for data collection from the onset involving a thorough process of investigation, observation and documentation to ensure that only true and verifiable data were collected (e.g. the questionnaire survey had to be launched twice as the first attempt had a low response rate of 27% due to insufficient follow-up and data).

Denscombe (2007) also stated that the tendency for the researcher to be overwhelmed with the technicality of the analysis process while ignoring the real essence of the research itself could be a disadvantage; to address this concern, the researcher consulted with the supervisory team regularly in order to help stay on track and to enable the focus to be clear at all times.

The tendency for too much data resulting in data overload was also considered as well as the possibility of 'false promise' arising from decisions made during the data analysis which may have wider implications on the type of results that are produced; to address this concern, the researcher tried to look carefully at all the data collected and identify the impact of each data on the overall findings and this was also discussed with the supervisor in advance as well. Denscombe (2007) asserted that quantitative analysis was therefore not as 'scientifically objective' as it appeared to be at a glance.

6.1.1.3. Types of Quantitative Data

Some types of quantitative data used in the surveys administered this research as described by Denscombe (2007) are explained hereunder:-

<u>a) Nominal data-</u> obtained from numbering items and putting them into a category. These types of data are simple to understand for example a set of data category based on gender, 'male/female' or ethnicity, 'White/Black/African Caribbean'.

<u>b) Ordinal data</u>- are similar to nominal data which are obtained from numbers of items given to particular categories, but in this instance, the categories exist in some 'clear, ordered, ranked relationship'. That is to say that the data within 'each category can be compared with the data in the other categories as being higher or lower or more than or less than, etc., those in the other categories'. Examples of ordinal data are those obtained from questionnaire surveys where by respondents are required to respond to questions on a five-point scale for example:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	2	3	4	5

In this case, the respondents who chose 'Agree' coded as '2' can be easily seen as more positive than those who chose 'neutral, disagree or strongly disagree' coded as 3, 4 and 5 but less positive than those who chose 'strongly agree' coded as '1'. This type of scale is called the 'Likert scale' in which data is ranked.

c) Interval data – these are also like ordinal data but in this case 'the categories are ranked on a scale' in a proportionate order such that the intervals between the categories can be identified and used during the analysis. Denscombe, (2007) stated that a good example was calendar years; 1970, 1980, 1990, 2000 and 2010. Here data can be easily compared in terms a year being later or earlier than another year and the span between or intervals of a set of years can be subtracted or added during analysis; for example the difference between 1970 and 1980 can be compared easily with the difference between say 2000 and 2010.

Other types of quantitative data are:-

d) Ratio data-these are similar to interval data, but have categories that exist on a scale which has an 'absolute reference point' e.g. weights, incomes and distances.

e) Discrete data- these come in chunks of whole units 1, 2 3 4 e.g. the number of children per family and cannot be expressed in terms of fractions.

f) Continuous data- these refer to variable data that are measured to the nearest unit as they do not come in neat discrete chunks because they are continuous e.g. human height, weight and age.

These were however not used within this research as they were not required.

6.1.2 Understanding Qualitative Research

Bell (2005) argue that researchers adopting a qualitative approach are more interested in understanding an individual's out-look of the world, therefore a qualitative researcher looks for insights instead of statistical perceptions of the world. Furthermore Bell (2005) stated that they are uncertain about the existence of 'social facts' and 'question whether a 'scientific' approach can be used when dealing with human beings.' With the above understanding, the researcher tried to capture the perceptions of the users of the e-learning spaces being investigated as well as those of the executives/financiers and architects/designers and e-learning champions thus, three different but related perceptions began to evolve from the data gathering process as each category of perceptions deserved to be respected and documented appropriately.

Denscombe (2007) argued that qualitative researchers tends to ‘adopt an approach to sampling which is based on ‘*sequential discovery*’ of instances to be studied and which lays emphasis on ‘the inclusion of ‘*special instances*’ more than is generally done in quantitative research.’ below are some benefits and disadvantages of qualitative research.

6.1.2.1. Benefits of Qualitative Research

According to Denscombe (2007) some of the benefits of qualitative analysis were; that ‘the data and the analysis are grounded’ i.e. the research descriptions and theories developed or generated by the research were ‘grounded in reality’ also that the data collected had the quality of being detailed and rich and that this approach allows for the acceptance of vagueness and oppositions as well as allowing for the researcher to use their ‘*interpretive skills*’ as there is the possibility of more than one explanation being applicable. This has been found to be true during this investigative process as outcome of the desk studies, forums, the case studies and observations of events and instances documented were rich, detailed and based on real life/on-going projects, involving real people, spaces and technology use with individuals having various opinions and explanations for their design and adoption as it were.

6.1.2.2. Disadvantages of Qualitative Research.

The main disadvantage noted by Denscombe (2007) was that the qualitative analysis method could be less representative of finding as they are mainly based on small number of instances compared to the quantitative approach. In order to address this, the researcher used a holistic approach for data gathering involving a process of investigative research of 15 case studies from which a smaller number of five examples were selected based on the case study selection criteria developed; after which the researcher then proceeded to carry out questionnaire surveys so as to obtain additional statistical data and facts that could be used to verify the initial findings in order to present detailed results without bias.

Another disadvantage noted by Denscombe (2007) was that results presented could be based mainly on the researcher’s personal views as well as the possible risk of interpreting finding from field notes or interviews out of context or the danger of ‘oversimplifying the explanation’. Again in order to deal with this, the researcher recorded every detail of site visit analyses of case studies and interviews given. After which the rough drafts of transcripts were then sent back for verification and corrections to the contacts and also in order to obtain authorisation to use and present the data collected. As Denscombe (2007) suggested, the process calls for extreme caution on the part of the researcher in order to minimise the disadvantage.

Denscombe also asserted that, the analysis of qualitative data tends to be ‘more time-consuming’ as the conclusions made by the researcher are not easily explained to the reader’ and may take longer compared to that of quantitative analysis which being numeric and statistical could be more easily analysed. This was found to be true in this particular study as the time used for qualitative data gathering in the form of forums, case studies and interviews as well as the verification of data and authorisation process took longer than was expected resulting in unexpected delays, because some of the respondents had to be e-mailed reminders over and over again before they returned the verified copies of the case studies/ interview drafts.

6.1.3 The Comparison between Quantitative and Qualitative Research

The distinction between ‘quantitative’ and ‘qualitative’ research relates to the treatment of data rather than the research methods and both research approaches are not mutually exclusive in practice as most social researchers seldom depend on one approach while excluding the other; but rather the assumptions made from the two approaches were usually shared, usually overlap and do not often rest on opposing sides (Denscombe, 2007).

The obvious differences listed by Denscombe (2007) are tabulated in 6.1 as follows:-

Table 6.1 Differences between Qualitative and Quantitative Research Approaches

S/N	Quantitative Research	Qualitative Research
I.	Often associated with numbers as the basis of analysis	Often associated with words or images as the basis of analysis
II.	Often interpreted with statistical analysis	Often uses descriptive analysis.
III.	Often lends itself to large-scale studies	Often suited to small-scale studies
IV.	Often looks at a specific aspect or focus in relation to other specific aspects	Often embraces a holistic perspective that views things in context
V.	Often allows for the researcher to be objective and detached such that data are presented independently without undue influence or bias from the researcher	Often involves the researcher's 'beliefs, values identity and social background' in the data collection, interpretation and presentation.
VI.	Often based on a programmed 'research design'	Often based on an emerging 'research design' (an on-going process in which evolving theories are tested such as 'grounded theory' Glaser and Strauss 1967 in Denscombe 2007)

Source: Denscombe (2007)

The type of Mixed-method design chosen was the sequential studies QUAL→QUAN the detailed explanation is presented in the section on mixed-methods design approach.

6.2 TOWARDS THE DEVELOPMENT OF THE RESEARCH APPROACH AND METHODOLOGY

In order to develop an appropriate research methodology, a good understanding of the research approach is helpful (Bell 2005). A view shared by Denscombe (2007) who also noted that majority of what is required to be known or accomplished with respect to the completion of a quality research can be documented in 'straightforward language' i.e.

without ambiguity or use of jargon, adding that the basis of a good research is determined by considering ‘certain elementary factors’ such as relevance, feasibility, coverage, accuracy, objectivity and ethics which, according to Denscombe (2007) if ignored could bring about criticisms and queries about the authenticity of the research findings. Good research is dependent on observing these main factors even though they may vary from subject area to subject area and student to student considering also that there may be no single accurate answer. To disregard these however, would result in a high possibility of a poor research outcome (Denscombe 2007).

Denscombe (2007) explained that in practical term, there exists several options and approaches to a research and these have their respective pros and cons/ ‘strengths and weaknesses and each is particularly suitable for a particular context’. This therefore implies that ‘the approach adopted and the methods of data collection selected will depend on the nature of inquiry and the type of information required’ (Bell, 2005:pg 8) as such one will be faced with the choice of various approaches, such as qualitative, quantitative, ethnographic, survey, action research etc. Bell (2005) also observed that the classifications mentioned above do not imply that as soon as one approach has been selected, ‘the researcher may not move from the methods normally associated with that style.’

6.3 RESEARCH APPROACH

With the above background understanding, it was inferred that the most suitable research method and approach would be one that will eliminate bias and pre-conclusions in order to enable the researcher present a detailed documentation of actual research findings and results in a simple straightforward language. Thus the research strategies adopted for this thesis from the onset were varied comprising of some qualitative approaches at the early stages of the research, and later moved towards the quantitative approach; as it was the goal of the researcher to cover every possible source in order to enable the robust gathering of data through the use of different tools. This is because the area being investigated was thought to be new, involving human and practical situations within the e-learning environment. However, the many data sources were reduced to relevant and manageable bits as the research progressed. Below is the brief description of some of the different research approaches that were considered.

6.3.1 The Mixed Method Research Approach

According to Denscombe (2007); Johnson and Onwuegbuzie (2004) the phase ‘mixed method’ refers to research that combines varied methods within one particular research project. Denscombe (2007) argued that the term applies to a research approach that goes beyond the limits of ‘conventional paradigms of research’ through the purposeful combination of research approaches derived from ‘different traditions with different underlying assumptions’. Denscombe (2007) also defined the ‘mixed method approach’ simply as that which uses both quantitative and qualitative methods; adding that this method has been very widely used and adopted by researchers in the past (such as Bryman, 1998, 2006; Layder, 1993, 1998; Silverman, 1995, 2000) but that the identification of the term ‘mixed methods approach’ was somewhat new and it had been made popular in recent years by authors such as Creswell (2003), Creswell and Clark (2007), Gorard and Taylor (2004), Greene et al (1989), Johnson and Onwuegbuzie (2004) and Tashakkori and Teddlie (1998, 2003). Some other terms used to refer to ‘mixed method approach’ are ‘mixed methodology’, ‘multi-strategy research’, ‘integrated methods’, ‘multi-method research’ and ‘combined methods research’.

The mixed method approach is distinctively characterised by three major features these were summarised by Denscombe (2007) and discussed hereunder.

I. *It combines the use of the qualitative and quantitative approaches within one single research project*; as was the case in this research project, wherein the researcher brought together certain tools and elements of qualitative and quantitative methods and data analysis in order to arrive at the research findings presented.

II. *There is a direct focus on the link between approaches*; the mixed methods approach is said to lay more emphasis on explaining why the varied approaches used were arguably more beneficial and how these alternative approaches can be unified and as such greater attention is given to the mixed methods research design.

III. *There is emphasis on providing practical solutions to research problems*; Denscombe (2007) noted that this was a pragmatist approach and that the mixed methods approach was ‘problem-driven.’ In order words, researchers using this approach were more concerned with providing answers to the research problem and considered that singular task to be their main objective and as such based whatever decisions they took on that thought, regardless of whichever method they deemed fit, as long as they obtained practical solutions to the research problem it did not matter.

From previous studies (Johnson and Onwuegbuzie, 2004) and literature reviewed, it has been noted that the mixed methods approaches have been used because of some reasons such as

- The perceived notion of ‘improved accuracy’ as stated by Greene et al. (1989: 259) in Denscombe (2007) that the use of the ‘mixed methods approach seeks convergence, corroboration, correspondence of results from the different methods’. This means that if for example, a researcher uses different methods and the findings are similar or the same, there is an increased confidence in the accuracy of data obtained. In the same vein, researchers could use the same principle of triangulation to investigate whether the results from say a postal survey will be same as that administered online in order to determine if the responses received online could be misinterpreted or distorted thereby checking the impact of the online method on the findings and as such increase the confidence of the researcher in the use of online questionnaires.

As was the case in this research work, where the mixed methods approach was adopted, the e-learning forums and workshop organised at the early stages of the research investigation helped to inform the research on the relevant and current issues of e-learning space design in HEI campuses; the analysis and interpretation of the feedback obtained from participants served as a the first set of practical basis for further exploratory studies on the perception and understanding of the users of e-learning spaces within HEI campuses. This also informed the questions which were used during the pilot survey and the site based analysis, interviews and case studies which followed thereafter. Finally, these data were then used to develop the quantitative questionnaire survey that was later launched. It was also based on the initial qualitative data obtained that the three groups of participants were identified and the final sample size of participants in this study was settled upon. To this end the researcher can agree with Denscombe (2007) on the following points:- The use of mixed methods approach has helped in the validation of results with respect to their accuracy; it has helped the researcher avoid bias in the research methods used and also assisted in the development of the research tools used during the project.

Other reasons given by researchers (Creswell, 2003; Creswell and Clark, 2007; Gorard and Taylor, 2004; Greene et al, 1989; Johnson and Onwuegbuzie, 2004) for the use of the mixed methods were that it created a more holistic image of the results i.e. the use of more than one research method produced a more wholesome and complete outcome especially in instances where the results obtained were complementary. Another reason put forward was that considering the limitations, and shortcomings which may be associated with any one particular method, the mixed methods approach allowed for the compensation of strengths and weaknesses wherever identified (Denzin, 1989:307 in Denscombe, 2007). Furthermore Denscombe (2007: p. 111) asserted that it enabled the further development of the data analysis 'with one method being used to inform another; as was the case in this study explained in the preceding paragraph above.

6.3.1.1. Types of Mixed Methods Design

There are different types of mixed methods research design, literature reviewed showed that; the basic principles of mixed methods research design were derived from quantitative and qualitative methods. Where quantitative – QUAN while qualitative – QUAL. These could be put into a variety of forms following different orders:-

Table 6.2 Types of Mixed Method Design

• **Sequential studies**	e.g.	QUAL→ QUAN
		QUAN→QUAL
		QUAN→QUAL→QUAN
• **Simultaneous studies**	e.g.	QUAN}→ QUAL}→
• **Multilevel designs**	e.g.	QUAN at macro level↑
		QUAL at micro level↓

Source: Denscombe (2007)

According to Denscombe (2007), the different methods adopted in a research could either be given equivalent status within the research or the sequencing could be such that one will be more or less dominant in the research i.e. QUAL→QUAN or qual→QUAN where 'quan' is less dominant and vice-versa.

6.3.1.2. Benefits of Mixed Methods Approach

The mixed methods approach as noted by Denscombe (2007) has the following advantages:- (a) provides a more comprehensive account of the subject being researched; (b) clearer links between different methods and the different kinds of data; (c) good use of triangulation; and (d) a practical, problem – driven approach to research'.

6.3.1.3 Disadvantages of Mixed Methods Approach

These were said to be (a) the likelihood of the time and cost of the research project to increase, due to the combination of different approaches; (b) The need for the researcher to develop and use skills relevant to both qualitative and quantitative research approaches: (c) disagreement between the results obtained from the different approaches.

It was based mainly on the advantages discussed above that this research approach was considered. However, the limitations and disadvantages of this method noted above led to the consideration of alternative research approaches such as the grounded theory approach.

6.3.1.4 Type of mixed method used in this research

The type of mixed method used in this research was the sequential studies {QUAL-QUAN}. The data gathering stage (after initial desk studies) began with qualitative data gathering in form of focus group discussions, then a pilot survey followed by the site based analysis of case studies and interviews. This stage was then followed by the quantitative data collected through the three part questionnaire survey administered.

6.3.2 The Grounded Theory Approach

This approach came to existence through the work of Barney Glaser and Anselm Strauss in 1967 and has since then been adopted by several researchers (Denscombe, 2007). The goal of the Grounded Theory approach is to generate theories that explain how some aspect of the social world 'works.' The goal is to develop a theory that emerges from and is therefore connected to the reality the theory is developed to explain, Glaser and Strauss (1967).

The constant comparative method is a method for analysing data in order to develop a grounded theory. Glaser and Strauss (1967) suggest that when used to generate theory, the comparative analytical method they described can be applied to social units of any size. The theory that this study sought to develop was summed up in the two hypotheses that this study also aimed to prove; that the design of e-learning spaces had an impact on the learning outcome of users and that users had various learning patterns and therefore required different types of e-learning spaces to support their teaching and learning requirement.

As Glaser and Strauss (1967, pp. 28-52) described it, this process involves:

- ‘Identifying a phenomenon, object, event or setting of interest’

- ‘Identifying a few local concepts, principles, structural or process features of the experience or phenomenon of interest’

- ‘Making decisions regarding initial collection of data based on one's initial understanding of the phenomenon. Further data collection cannot be planned in advance of analysis and the emergence of theory’

Also they explained that for a researcher who wishes to engage in ‘theoretical sampling,’ – the vital question to ask is ‘what group or subgroups does the researcher turn to next to collect data?’ and advised that ‘subsequent sampling decisions should be purposeful and relevant’ as the basis for selecting ‘comparison groups’ was their ‘theoretical relevance for fostering the development of emergent categories’.

6.3.2.1. Procedures for Coding in Grounded Theory Approach

Strauss and Corbin (1990) described several flexible parameters for coding data when involved in a Grounded Theory analysis:

- Open Coding - "The process of breaking down, examining, comparing, conceptualising, and categorising data" (p. 61).

- Axial Coding - "A set of procedures whereby data are put back together in new ways after open coding, by making connections between categories. This is done by utilizing a coding paradigm; involving conditions, context, action/interactional strategies and consequences" (p. 96).

- Selective Coding - "The process of selecting the core category, systematically relating it to other categories, validating those relationships, and filling in categories that need further refinement and development" (p. 116).

6.3.2.2. Advantages of Grounded Theory approach

Some of the advantages listed by Denscombe (2007) are as follows-

- The idea of Grounded Theory is perceived as being current in the research community and has become a well-known rationale for qualitative research especially small scale projects.

- The Grounded Theory approach is thought to be 'fairly adaptable' because it is useful in a variety of qualitative data collection methods (such as interviews, observations and documents) and types of data e.g. interview transcripts, field work notes and texts.

- The Grounded Theory approach is focused on human interaction and particularly on that which is practical (pragmatic philosophy), thus it therefore lends itself to studies in areas such as health, business and education, that have interests in understanding and upgrading the conditions.

- The systematic qualitative data analysis strategy developed by Strauss is considered to be more helpful to new researchers who may feel overwhelmed by the daunting task of data analysis and building up theory.

- The use of computer software for coding and data sorting is possible for the process of data analysis.

- The approach includes the process for proposing modest theories from the data collected.

- The explanation or interpretation of data are grounded in reality built on a solid basis of evidence.

- The approach allows for a level of flexibility in the selection of cases for inclusion in the sample and analysis of data.

6.3.2.3. Disadvantages of Grounded Theory Approach

The disadvantages listed were the following:-

- The approach does not allow for precise planning as the use of theoretical sampling does not make it easy to make advanced prediction of the type of sample that will be used or the actual sample size, or to anticipate when the research will be completed.

- There is a propensity to ignore the wider contextual factors when explanations are focused on specific cases of behaviours in particular situations such that the theory generated from the data might forget about the impact of the historical background to the events, or the political issues (e.g. the social class, globalization, gender and race inequality) which may add important facts to the theory explaining the phenomenon being researched.

- The concept of an 'open minded' approach suggests that the researcher puts aside prior experiences and influences for the purpose of data analysis. This is often not practical in reality. It also brings about questions on weather researchers using this approach should carry out literature reviews or not on existing ideas and theories and past findings in that field and to what extent literature reviews be allowed to influence the new theory being built. Therefore 'within the Grounded Theory approach, different researchers adopt different positions on such issues.'

- The systematic data analysis method developed by Strauss and Corbin (1990, 1998) can be perceived as daunting in terms of the complexity of the process involved. This was a point of disagreement by Barney Glaser, who initially worked with Strauss as he argued that the 'guidance template and framework developed by Strauss for qualitative analysis was against the principle of grounded theory since it imposed categories and codes on data, rather than allowing these emerge naturally.'

- The approach could be judged as being 'empiricist' i.e. because the theories developed relies to a large extent on empirical data obtained from field work, where it is expected that the explanations should exist solely within the data accumulated waiting to be discovered by the researcher. According to (Layder, 1998 in Denscombe, 2007) the inductive approach is an inexperienced.

6.3.2.4 Application of Grounded Theory Procedure in the Research

With the understanding of the procedures for grounded theory, its advantages and disadvantages, the approach was chosen because it was considered to be the most suitable method for obtaining and analysing data for the study as it allowed for qualitative data gathering methods in form of unstructured interviews, focus group discussions (E-learning forums) which were useful at the onset of the research as they enabled the examination of the practical issues associated with e-learning space design in HEI campuses. It was also thought to be useful for data analysis as it enabled data to be grouped or categorised and coded in a way that can be easily understood.

The research as earlier stated is a fact finding exploratory research in which site based analysis, interviews and case studies and questionnaire surveys were done; furthermore as the study focused on human interactions and participants' points of view to generate explanations, it was thought that to achieve the outlined project aims a method such as the grounded theory approach; that enabled systematic data collection and analysis with allowance for research question and hypothesis to evolve without pre-conclusions was required in order to enabled the research theory to be developed, investigated and resolved.

As stated by Strauss and Corbin (1990) '*the initial questions or area for observation' ought to be founded on ideas draw from literature or experience' but that since these concepts do not yet have established theoretical significance to the evolving theory, they must be regarded as provisional. On the other hand, they serve as a beginning focus, a starting point for the researcher.*

To this end, at the beginning of the field work, when the desk studies and literature reviews were done, the exact sample size to be investigated or included in the research was not known but rather the investigation began with the consideration of what type of participants to be contacted. Therefore the concept of four user groups comprising of students and staff of HEI institutions, directors of estates/ e-learning champions and architects / designers of e-learning spaces evolved in line with the open coding procedure. During the process of data collection as theory began to evolve the large category initially developed for selecting areas of investigation became narrowed. The staff and students became merged into one group reducing the groups to three groups in order to refine the study focus and depth. While the categories of space types selected for investigation were seven in total comprising of Group teaching/learning spaces, simulated/ specialised learning spaces, immersive environments, social and peer to peer learning spaces, learning clusters, individual spaces, and external spaces. Below is the frame work that was initially developed for obtaining data from the users of e-learning spaces at the initial process in line with the concepts of the grounded theory approach. This framework was also informed by the findings explained in the discussion hereunder.

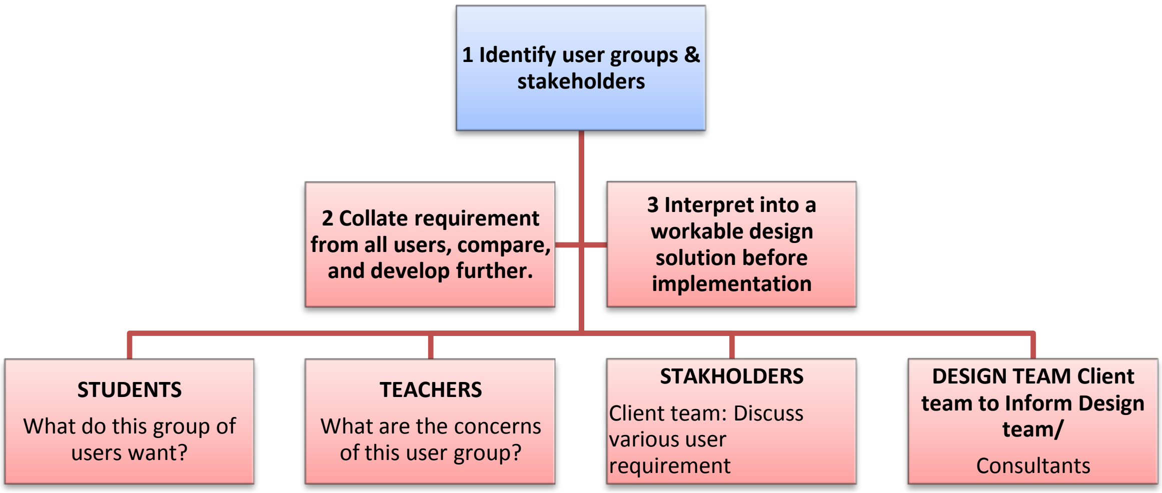


Figure 6.1 Conceptual Framework for Initial Data Gathering for E-Learning Spaces

Figure 6.1 above was a preliminary strategy for data gathering that was put together to enable the researcher get a broader picture of the aspects to be investigated. It was made up of three logical steps which were i) Identify the users of e-learning spaces, ii) Collate the requirements from all users and compare findings and develop further and iii) interpret findings into a practical design solution that can be implemented.

The initial thinking expressed in figure 6.1 was therefore a simplistic categorisation of the participants to be investigated during the field work and it did not give details of group size / coding adopted and thus it needed to be further developed so that the categories could be structured appropriately.

Also to help achieve an in-depth focus and direction for investigation, development of open ended research questions were thought to be the next logical step. Thus the research questions that evolved as listed in section 1.4.1. The questions were used to develop the survey questionnaire and interview questions which were discussed in the section on analysis.

In addition to the above, as the research began to obtain a clearer focus it was thought that a categorisation of data to be obtained and investigated as well as how this was to be done would be helpful in order to bring some structured into the inquiry process. Therefore two broad categorisations were considered as tabulated in 6.2; comprising of the users of e-learning spaces as well as the space types as shown below.

Table 6.3 Initial Categorisation of Areas for Investigation

Categories	**Members/Types of categories identified**	**Data gathering tool proposed**
Users of E-learning spaces	Staff, Students, Executives/Directors, Designers/Architects	interviews/questionnaire
E- Learning Spaces types	Group teaching/learning spaces, simulated/ specialised learning spaces, immersive environments, social and peer to peer learning spaces, learning clusters, individual spaces, and external spaces	literature review, site based observation, interviews, questionnaire, case studies

Another set of categorisation which was a derivation from the two categories considered in table 6.3 was based on the source and type of data being gathered, with respect to how the design of the different space types identified in this study were created. It was also based on the prior understanding that the data source and type of data could be qualitative or quantitative based on previous desk studies.

Table 6.4 Representation of the Structure of the Thinking for the Further Categorisation Developed.

From the space categories (code number 1-7)	Factors that influenced the space design coded (i-iv)	Source of data and type of data (qualitative- ‘qual’ or quantitative ‘quan’)
where space type 1- group teaching/learning space	could be either user led design (i)/Technology led design (ii)/ Institution led design (iii) or unplanned space design (iv)	quantitative/qualitative

where space type 2- simulated/specialised learning space	could be either of i-iv	quantitative/qualitative
where space type 3- immersive environments	could be either of i-iv	quantitative/qualitative
where space type 4- social/peer to peer learning space	could be either of i-iv	quantitative/qualitative
where space type 5- learning clusters	could be either of i-iv	quantitative/qualitative
where space type 6- individual spaces	could be either of i-iv	quantitative/qualitative
where space type 7- external spaces	could be either of i-iv	quantitative/qualitative

After the general grouping of the data sources into two categories, the findings from the desk studies and e-learning forums flagged up certain factors that could influence space design such as the users, the institutions' strategic vision and availability of funding, technology uptake and impact as well as unplanned situations that eventually led to the designing of learning space designs. These factors for space design were assigned codes based on the two broad groups as shown in table 6.4.

The two hypotheses discussed in section 1.4 of chapter one were therefore developed from this process.

6.3.3 Case Study Approach

Yin (2009, 1994) defined a case study as" an empirical inquiry that investigates a contemporary phenomenon within real-life context- when boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used".

McDade (1998) argued that "a case study is a documented description of a problem or situation which does not include analysis or conclusions but only the facts of the story presented in a sequential order".

Denscombe (2007) states that a case study could be 'discovery-led' in which case it would involve; a description of 'what is happening in a setting', an exploration of the 'key issues affecting those’ within the case study setting and a comparison of settings in order to ‘learn from the similarities and differences between them’. Or it could be ‘theory –led’ in which case it would entail; an explanation of ‘the causes of events, processes or relationships within a setting’, or it can be used ‘as an illustration of how a particular theory applies in real-life setting’ or a case study can be used ‘as a test-bed for experimenting with changes to specific factors or variables’.

The case study approach was therefore considered to be particularly suitable for this research as it was done by an individual researcher and it provided the opportunity for an aspect of a problem to be investigated thoroughly (Bell, 2005). In this case the aspect of the design of e-learning spaces within selected HEI campuses is what was being investigated. Bell (2005) also stated that case studies may be done in order to follow up or add relevant data to a survey or it could precede a survey (as it was done in this research) and explained that it could be suitable when a researcher identifies an ‘instance which could be the introduction of a new way of working, adaptation to a new role, or any innovation or stage of development in an institution.’ As it were, this study aimed to develop a novel methodology for e-learning space design in HEI, therefore ‘evidence was collected systematically, and the relationship between variables (in this particular case these variables were: the space design issues, the perception of users and the technology use) had to be studied (where a variable is a characteristic or attribute) and the investigation methodologically planned’ (Bell, 2005). The book also stated that although observation and interviews were most often used that no method was excluded. Therefore, in this research work, the researcher conducted interviews and carried out site-based analysis and observations/case studies along with other methods of investigation.

With the above considerations, it was decided that the case study method was a very useful tool for the investigative/descriptive study being conducted. The benefits include the provision of the opportunity for selection and observation of a particular case or cases. Also “it lends itself to the study of processes and relationships within a setting.” And it also embraces the use of more than one research method though in research practice, the case study approach has been lined-up with qualitative research much more than quantitative research (Denscombe, 2007). Therefore in this research, a number of case studies where an e-learning space within a HEI campus was designed, or in the process of being implemented were selected, investigated and reported as outlined in the objectives of this study. The detailed process of case study selection, criteria and analysis are discussed in the case study analysis section 6.8.3.1.

6.3.4 The Questionnaire Survey Approach

A questionnaire survey may set out to gather data from a selected representative of a number of people often referred to as a sample, for example the census. From these, the results are then presented as 'being representative of the population as a whole' (Bell, 2005). There is however a need to be careful according to Bell (2005) as the selection of an adequately representative sample may be a problem. Also Bell (2005) noted that in surveys, respondents ought to be asked the same questions, under the same circumstances and as such the choice of wording should be such that all questions are understood to be the same by all respondents.

Surveys should help the researcher describe, compare and relate occurrences as well as demonstrate that some features can be categorised. In order words surveys can provide answers to the questions What? When? How? and Where? But may not necessarily answer the question of Why? As this refers to the effect and cause relationship and may therefore not be easy to prove by using a survey (Bell, 2005).

Denscombe (2007) agrees with Bell (2005) and stated that questionnaire surveys should be designed to obtain information which can be later used for data analysis; the questionnaire ought to contain a written list of questions. These questions ought to be written with care to enable consistency in the use of wordings such that questions mean the same thing to each respondent.

The most popular types of questionnaire surveys now in use are the postal type and the internet type. According to Naoum (2003) the postal type was said to be less expensive and used widely while the personal interview type were considered to be useful where face-to-face contact was required. However, research shows that they are no longer commonly used in research as the risk of misinterpretation of data by the interviewer were said to be higher when using this method (Naoum, 2003). For the purpose of this research work, the web-based type of questionnaire survey was used as a data gathering tool; administered electronically through web based software. This was considered to be a much faster and more economical means of data gathering compared to the postal survey and personal interview types.

The method of planning, design and structure of the survey used in this research are explained in detail in the field work section 6.8.

6.3.5 Action Research Approach

This is defined as applied research (Bell, 2005), an approach that is relevant in circumstances where ‘specific knowledge is required for a specific problem in a specific situation, or when a new approach is to be grafted on to an existing system’ (Cohen and Manion 1994:194 in Bell 2005:pg.8). The aim of action research is to put forward proposals for ‘good practice’ in order to solve a problem or augment the output of an administration and people by making changes to the policies and procedures by which they function (Denscombe 2007). This can pose difficulties where the views of participants are challenged or expected to change. Action research is a continuous process of investigation, review, feedback and evaluation and the value of the findings is measured by the comprehension of, as well as the level of expected transformation that is achieved (Brown and McIntyre 1981:245 in Bell 2005:pg.9). Furthermore, Denscombe (2007) also reiterated that the process of action research always invariably involves or affects others, and as such the researcher ought to ensure that the required standard of ethics, confidentiality and anonymity are maintained.

Implementing action research, the researcher carried out desk studies in form of; literature reviews, forums/discussions and pilot surveys in order to ascertain the viability of the research endeavour. The researcher was then able to identify the specific problem and developed some research questions which subsequently led to the direction of the research focus adopted and the detailed investigations carried out, in order to put forward proposals in form of a toolkit that will provide best practice guidance for the design of future e-learning spaces on HEI campuses. Also from the onset of the research, all necessary ethics approval as well as measures to ensure that confidentiality and the anonymity of participants were obtained and set up according to expected standards.

6.3.6 Other Approaches

Other research approaches not used include; Experiments, Ethnography and Phenomenology. These were ignored because they were not required.

6.4 Data Collection Tools

Data collection tools include:

- Interviews
- Focus groups
- Questionnaires
- Case study

Among these, interviews, focus groups, questionnaire and case study were used.

6.4.1 Interviews

Interviews are recommended for gaining insights into things such as people's emotion, views, feelings and experiences (Denscombe, 2007). According to Bell (2005), it is the duty of the researcher to ensure that the participants are made aware of the purpose of the interview before hand, as well as obtaining informed consent in line with ethical standards.

6.4.1.1 Types of Interviews

From literature reviewed the main types of interviews are namely: - structured, semi-structured and unstructured. This could be done in two forms, either as one- to-one or group interviews.

- Structured interview was defined as an interview with rigid control over the type of questions and answers. It is thought to be similar to a questionnaire which is administered face-to-face. In structured interviews, each respondent is asked the same questions and are offered a set of answers to choose from. This is said to be suitable for obtaining quantitative data as the pre-set questions and answers allows for standardisation and subsequently ease of data analysis.

- Semi-structured interviews have some similarities to structured interviews. In this case the interviewer also develops a planned list of questions to be asked but, the interviewer is willing to be flexible with the line of questioning and most especially the interviewee is encouraged to express opinions and give clear explanations on the issues being asked. Therefore, the response given is often in the form of open-ended answers.

- Unstructured interview takes a different approach to the structured type. Here, the interviewer introduces the subject area and allows the interviewee express opinions, thoughts and ideas and then continues the questioning based on the train of thoughts expressed. The concept here is to allow the interviewee speak their mind in their own words such that the outcome is to discover new things about the issues raised rather than checking out pre-known ideas.

6.4.1.2 Advantages of Interviews

The advantages listed by Denscombe (2007) and also by Bell (2005) are as follows

- There is a depth of information obtainable from interviews. It was stated that interviews are generally beneficial for gaining valuable information, data and insight about the research subject as the participants make meaningful contributions based on their wealth of experience or perceptions.

- There is little or no need for equipment and the interviewer only needs to use conversational skills in order to obtain an understanding of the topic of research enquiry, the respondents' ideas, opinions and perceptions. Interviews are also a good tool for data gathering.

-Informants can talk about what they consider to be of priority to them and this can help the researcher determine the issues that are of greater importance or concern.

- Interviews are considered to arguably be the most flexible means for data collection in research. Changes can be easily made say from a semi-structured to unstructured interview depending on the interviewee's response to the line of questioning and the extent to which the interviewer is willing to adapt.

- Interviews are noted to record a higher response rate than other data gathering methods. This is because interviews are often pre-arranged, for a convenient location and time; this ensures that the response rate will be high.

- The validity of the data obtained from interviews can be checked for accuracy and relevance immediately they are collected. This helps to reduce errors.

6.4.1.3. Disadvantages of Interviews

Some of the disadvantages of the interviews as explained by Denscombe (2007) are as follows:

-Interviews are thought to be time consuming. The analysis of data takes more time to be done unlike data obtained from a questionnaire survey for example which are ready for analysis immediately after they are collected.

- Data analysis from unstructured and semi-structured interviews produce responses that are often not standard and need to be transcribed and coded before analysis can begin.

- Consistency and objectivity can be difficult to achieve due to the impact of the interviewer who has to put the data into context and this affects reliability.

- Interview effect may occur where the data obtained is based on what the people say rather than what they do which may not be true in reality. Also the presence and identity of the interviewer may influence the response of the interviewee; internet interviews, without visual and verbal contact are said to go a long way to reduce this problem.

- Inhibitions on the part of the interviewee may surface due to the use of recording equipment.

- Face-to-face interviews may cost the interviewer time and money as travelling to carry out interviews may be expensive especially if the interviewees are in a different location. After consideration of this method and its suitability for this research, informed consent to interview some participants was obtained. Thereafter, semi-structured interviews were done on a one –to- one, face- to- face manner to enable the gathering of qualitative data. The reasons for using the one-to-one method as noted by Denscombe (2007) were as follows: - it was easier to arrange to meet one person at a time, it was easier to focus on the opinions and views expressed by each individual person without confusing data, it also was easier to control and guide the interview agenda on a one – to–one scenario; and the notes taken were easier to transcribe during data analysis. The groups of persons interviewed were users' of e-learning spaces, executives/directors of estates and the designers/ persons that initiated the change (e-learning champions).

To ensure the success of this data gathering approach, consideration was given to the type of questions asked as it is necessary to ask the right questions. The interview questions asked focused on the following areas:-

- The users' requirement and inputs to the space design vs. technology available and facilities provided,

- User preferences within the space designed and flexible use of an e-learning environment,

- The design strategy and what was the underlying pedagogy/teaching and learning culture of the HEI investigated,

- The problems associated with the design, security and delivery of such infrastructure,

- The people behind the change, why it was initiated and what others feel about it,

- Funding sources, budget, completion time and quality,

- User training and measurable outcomes, and

- Lessons learnt and things to be avoided in future,'

The analysis section explains the findings from the interviews that were conducted in more detail.

6.4.2 The Focus Groups

From literature reviewed, the term 'Focus Groups' refers to a small group of people brought together by a facilitator (the researcher) with the goal of looking at attitudes, perceptions, feelings and concepts about a particular subject. During this exercise, the participants' are encouraged to interact, discuss and share ideas. The interaction then enables the researcher understand the different perceptions people have about the subject and the reasons why. It is a process of sharing and comparing personal views and responses on a range of issues within a research subject (Morgan, 2006: 121 in Denscombe, 2006).

Denscombe (2007) explained that a focus group helps the researcher get an understanding of underlying concepts and meanings that explain particular views and opinions; focus groups allows the exploration of new areas of research where the researcher quickly wishes to obtain background understanding from participants about a research topic; as was the case in this research endeavour, where the researcher wanted to quickly get an understanding of participants perception about e-learning space design in HEI campus from the onset of the research.

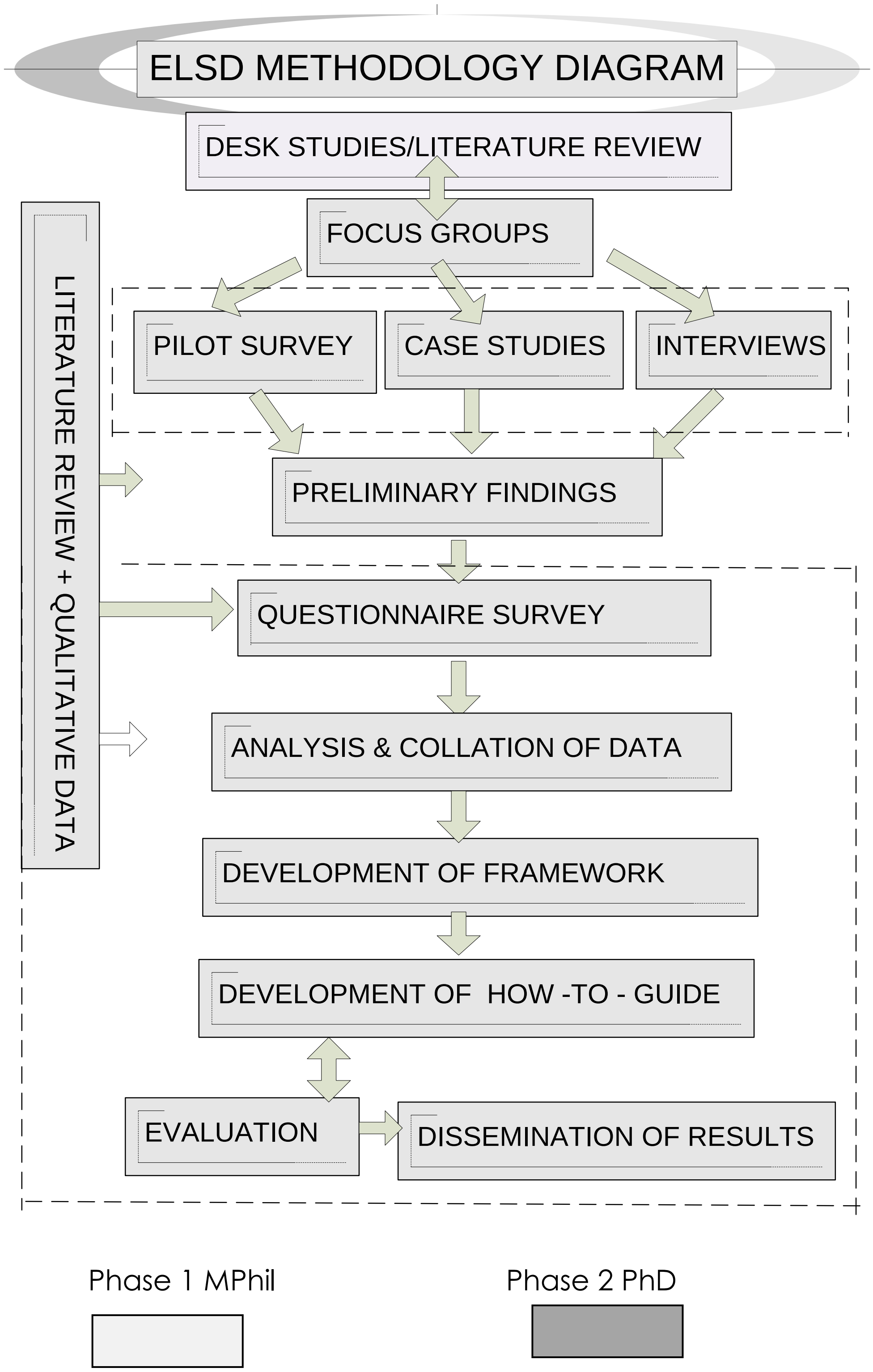
Therefore, further to the success of the three-part E-learning Forums organised at the onset of the research, a positive feedback was obtained from participants on the issues that this research seeks to address. The results from the forum are discussed in the analysis section.

6.5 THE ROLE OF STEPS DEVELOPED IN THE METHODOLOGY

A Methodology Diagram that puts the research method and approach adopted in a clearer context has also been developed and discussed as shown in figure. 6.2.

As illustrated in the figure 6.2, this research work involved; the identification of a problem; definition of research questions; and systematic secondary data collection from desk studies and literature reviews. Primary data were collected thorough observation and documentation of case studies; interviews and surveys in order to develop the theory and thus a framework; subsequently this was adopted into an e-learning space design toolkit. The inductive and the grounded theory approaches were considered as the most appropriate to be used as explained above. In addition to which a mixed method research approach was adopted. The overall steps used for the research method involved both qualitative and quantitative methods i.e. data collection from desk studies, literature reviews, interviews, questionnaire surveys as well as descriptive and collective case studies. This was because a holistic, in-depth investigation of the subject area was required (Yin, 2009). These were then analysed, before the frame work was developed, and evaluated. Finally conclusions and recommendations were made from the research findings which were then disseminated.

The objectives of the research were also defined and refined as set out earlier in section 1.5. The stages of the methodology adopted as shown in figure. 6.2 were used to achieve the research objectives. The role of each step has been explained hereunder.



I. DESK STUDIES:-The first part of the research methodology was desk studies comprising of literature review of previous research on the proposed subject area in order to achieve the first objective which was; **'To identify basic elements for good design in e-learning space design in** HEI'. This stage involved extensive and thorough literature review of materials/resources available at the University Learning Centre, such as books, journals and online materials. Also during this stage, the identification of the research problems was done and used as points for discussion during the forums.

II. FOCUS GROUPS:-E-Learning space design Forums/workshops was the next step on the research methodology developed. This step enabled the input of staff, students, designers and HEI executives as well as industry partners to be captured. Additional literature reviews were done in order to compare what the forum participants from HEI had expressed. This was as a precursory step in the overall research as explained in section 6.8.1. The second objective was therefore achieved through this process – **'To identify essential user learning patterns that affect e-learning space design in HEI'.**

III. PILOT SURVEY: - The outcome of the focus groups and further desk studies led to the approach of developing a pilot survey. As it was essential to pilot a survey to see the response rate and data quality obtained from the questions asked It enabled the development of the robust criteria used for the selection of the case studies/ site based analysis carried out.

IV. CASE STUDIES and INTERVIEWS: - these stages involved scheduled semi-structured interviews of a random selection of participants. This was done alongside the case study visits. This step enabled the site based analysis of actual existing spaces, observation and acquiring of qualitative data. Furthermore, feedback and data collected were useful in the development of the structured questionnaire surveys administered.

V. PRELIMINARY FINDINGS: - the next stage in the methodology developed was that of sorting out the data obtained from the three focus groups, pilot survey, site-based analysis and interviews into preliminary findings. The critical review of similar research work done in this regard was also done alongside. This stage was important in evaluating the research findings and process so as to prevent relevant data from being misinterpreted or muddled up. Furthermore it was useful in the process of development of questionnaire surveys. This then led to the achievement of the third objective which was-***'To develop a set of guidelines for good practice in e-learning space design in HEI'.***

VI. QUESTIONNAIRE SURVEY: - The next stage in the methodology was that of development and administering of questionnaire surveys as discussed in the section on questionnaire surveys. This step enabled quantitative data to be obtained from the three different groups identified earlier in the study.

VII. ANALYSIS and COLLATION OF DATA: - This was the next stage in the methodology developed. At this stage, the findings were used for analysis of data in order to present realistic and practical guidelines. This was achieved by the careful interpretation of data that was fed into the process of the development a framework.

VIII. DEVELOPMENT OF FRAMEWORK: - The next stage in the methodology was the development of the framework. In line with the fourth objective; '**To develop a model framework for the design of e-learning spaces in HEI.** This step was essential in order to achieve the research aim as it was the framework developed that was adapted to the How-to-guide which was the research output.

VIII. DEVELOPMENT OF HOW- TO-GUIDE: - After the framework was developed, the process of putting the how-to-guide together was the next step in the research methodology which also goes to achieve part of objective five. This step involved simultaneous evaluations as well as using the framework along with the guidelines proposed combined with the design illustrations developed to provide guidance on how to design e-learning spaces in HEI.

IX. EVALUATION: - The next stage in the methodology was; **To evaluate the framework** this step was also in line with the fifth objective. The evaluation was done by persons outside the research supervisory team in order to eliminate bias and also to ensure that the research approach and steps taken to develop the framework were original and appropriate. Furthermore, the evaluation was essential in validating the framework and research outcome before the adaptation into **a 'How-To-Guide'**

XI. DESIMINATION OF RESULTS: - The final stage of the methodology developed is in line with the last objective **'to disseminate results and research findings'**. This was a necessary step as it afforded the researcher the opportunity to present the preliminary research findings, initial recommendations as well as the final results of the detailed analysis of data. This process also allowed for peer reviews from conference papers, seminars and workshop presentations and journal papers. In addition to the above a well written thesis was produced.

The method of research enquiry adopted was therefore qualitative and quantitative i.e. a mixed method approach which began after the initial phase of grounded theory had been used to develop the background theory and research strategy. Examples of some projects which have adopted this strategy in real life include: JISC BSF Green Building, Inclusive design example from the Eden project.

6.6 DATA COLLECTION AND ANALYSIS

According to Bell (2005) we all learn how to do research by actually doing it; but a huge amount of time could be lost by inadequate preparation.' Furthermore, Bell noted that different styles, approaches and methods could be used for data collection or analysis but that no approach prescribes or condemns any specific method but that if the data-collecting instruments were properly devised and properly piloted, the ground-work for the collection, analysis and presentation of data would already have been done. Thus the research design/ technique adopted were selected with this in mind. As noted by Naoum (2003) the research approach to be employed "depends on the nature of investigation and type of data and information" required as well as that which is obtainable within the time frame available for the research. This study adopted several data collection techniques and strategies because the types of data being sort for were both qualitative and quantitative in nature. The approaches considered were thus hinged on these considerations as a lot of time, effort and care was put into the process of data collection in-order to acquire as much relevant data as was possible in this regard.

The techniques adopted consist of fieldwork research and secondary data collection technique.

I. Fieldwork research involved primary desk studies prior to data collection and was done by organising E-learning focus group discussions (three part forums), conducting case study and site based analysis, interviews and administering questionnaire surveys. All aimed at obtaining qualitative and quantitative data that would shed light on the research problem being investigated. The detailed explanation of the field work is presented hereunder in section 6.9-6.10.

II. Secondary data collection technique involved the collection of data from secondary sources through desk studies i.e. literature reviews of books, journals, reports, conference papers etc. this helped to give a background understanding of the research topic and the advantage of this was that it helped saved time and cost (Naoum, 2003).

6.7 METHOD OF ANALYSIS AND REPORTING OF FINDINGS

Raw data obtained from questionnaires, interviews, case studies etc. need to be recorded, analysed and interpreted; a hundred pieces of interesting information will be insignificant to a researcher or a reader except they have been grouped and interpreted (Bell, 2005). Because the strategy selected for this study combined both qualitative and quantitative approaches, the analysis of quantitative data collected was prepared in form of descriptive statistics method which as stated by Naoum (2003) is the arguably the most adequate to meet the needs of the research; while the qualitative data were analysed using case study analytic procedures as well as Content analysis and Thematic analysis. It is believed that the process of analysis is one that can present a broad view of the research outcome. The results were presented in form of charts and tables showing percentages, numeric values, frequency distribution or category frequency summarising the large data into simpler groups and categories that are easy to appreciate. To this end, a schematic structure that summarises the method of analysis has been put together and is presented hereunder in figure 6.3

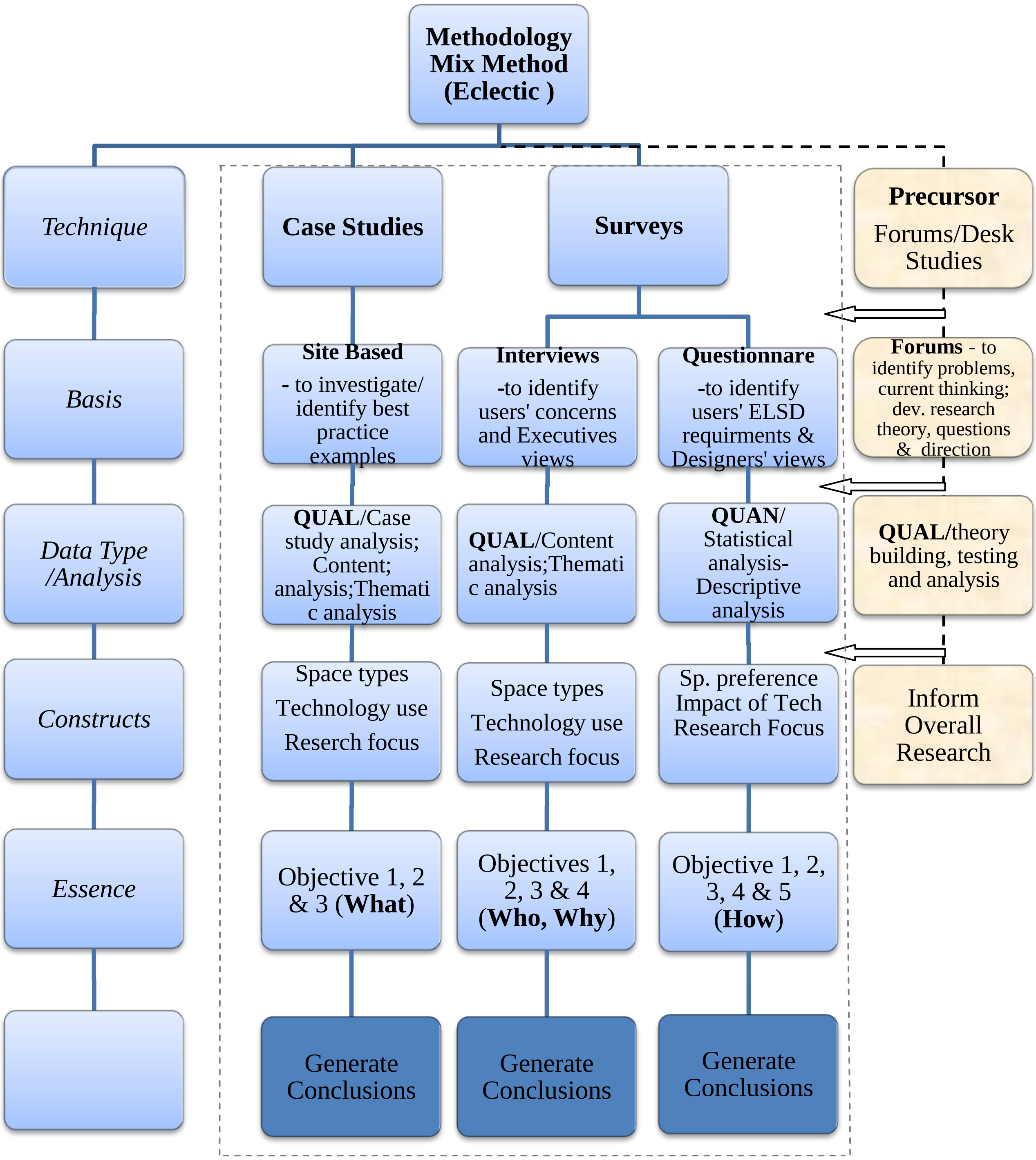


Figure 6.3- Schematic Diagram Summarizing the Method of Analysis

6.8 SUMMARY ON METHODOLOGY AND RESEARCH APPROACH

This first section of the Chapter presented a general understanding about the research approach and methodology and how this was developed. It attempted to explain how the development process evolved based on consideration of various research approaches, and strategies. The various research techniques/data gathering tools considered and used during the study included; Grounded theory approach, case studies and surveys – interviews and questionnaires. The mixed method approach was considered within the context of eclectic studies as this was thought to be the most suitable methodology for the studies.

The discussions presented in this section of the chapter are intended to clarify to the reader the understanding of the overall research methodology and various techniques used in order to achieve the research aim and objectives. It is not intended to confuse the reader as it were, but to explain the concept of the researcher; that of carrying out detailed investigations (hence the various techniques used) so as to present a holistic, in-depth investigation of the subject area as it were (Yin, 2009).

6.9 PART TWO- THE FIELD WORK.

This second section of the chapter is dedicated to the field work done during the research. It presents the idea behind the development of the tools used; the focus groups (E-learning Forums); the pilot studies; criteria for case study selection, the structured questionnaire survey and the semi-structured interviews. How all these were then used in the research along with the outcome of the e-learning forums done earlier at the onset of the research, and how the forums helped to inform the research direction into the investigation of E-learning space design on HEI campus.

6.9.1 Focus Groups- E-Learning Forums

At the beginning of this study, it was thought that E-learning Forums be organised alongside the literature review being done. It was assumed that the Forums would serve as current sources of information from the Stakeholders, Directors of Estates, Designers and Architect, teaching staff, facilities managers, CELT directors, Librarians and other Learning & Teaching Coordinators from HEIs. In order to organise this, the task involved identifying the following:-

I. What the focus of the Forums should be i.e. E-learning space design in HEI and issues

II. What was expected to be achieved through this data collection method (qualitative data, and focus group contacts)?

III. Who should be invited to participate in the Forums- the users- staff, students, visitors and people involved in the finance, construction and design of e-learning spaces?

IV. The structure and programme for the day i.e. start time, venues, the activities to be done till the end.

The planning of the Forums took about six weeks during which the idea and programme structure for the focus groups was discussed and planned. The target was for three sets in months of February, March and April of Year 1 of the study in order to allow participants plan ahead to attend. After this, ethics approval was obtained and then the contacts identified were invited via e-mail to participate. The responses were received and the three part forums were successfully organised and executed. (The invitation letter and programme of events developed are included in appendix D; the participants have been acknowledged as well).

Following the success of the E-learning Forums, a positive feedback was obtained from participants on the issues that this research seeks to address. The details of forum participants and the results from the exercise are discussed below. However, the contacts made with the participants from HEIs were the main source of the initial feedback pilot survey discussed hereunder.

Conduct of the focus groups: this took place in February, March and April of the first year of research at the University of Wolverhampton. Participants were encouraged to discuss freely and guided by a facilitator (member of the supervisory team) while the researcher took notes as well as video and voice recording with a Camcorder and a Dictaphone.

Results: - According to feedback received from participants, it was thought that the forums broadened their understanding of the issues raised and discussed; that the workshop was well worth attending as it forced fresh thinking, they enjoyed the informal breakout sessions and collaboration with other HEIs present, they appreciated the opportunity of seeing the first-hand examples of how E-Learning has been embedded in space design at the University of Wolverhampton. Someone recommended that workshops and forums of this nature be adopted as part of strategic estate planning in HEI's; A participant also stated that the forum was a good opportunity to listen to user concerns/issues on project examples discussed. On the whole, the Forum outcome was of significant benefit to all who participated and to the on-going research data gathering process. The contacts made with the participating HEIs are the main source of our initial feedback pilot survey discussed below.

6.9.2 The Pilot Survey

It was thought that a pilot survey was required to test the quality and suitability of questions asked so as to determine whether they would generate adequate data in line with the suggestion of Denscombe, (2007), the sample frame for the research was determined. A list of academics (staff) and students in HEI was obtained and were contacted via e-mail; members of the Association of University Directors and Executives (AUDE) were also invited as well as a wide selection of Architects, and Designers of HEI campuses. The reply to the invite came from willing participants from within the academic environment and external although it was understood that some contacts may decline to co-operate. Therefore after each forum, a pilot survey was administered to the forum participants who attended.

Result: The pilot survey and interviews showed that end users of e-learning spaces were not usually involved in the design process. Some users felt the facilities available were unsuitable for their teaching and learning requirements as observed by a dyslexic student.

6.9.3 Case Study

The basis for the use of case study method as a data gathering tool was discussed in section 6.3 above. However, it was also based on reasonable considerations, that this method was adopted as a very useful tool for the investigative/descriptive study being conducted. Previous study indicated that the case study approach was used for obtaining qualitative data much more than quantitative (Denscombe, 2007). The data required/obtained from this method were qualitative in nature hence this tool was used.

According to Joseph Rykwert, in Pearce (2001), Architecture could have significant power on a university campus and offer a central attraction for the university, especially for a university that has evolved from a combination of several buildings over time. Hence the case studies and site based analysis carried out were also selected in order to investigate this view point.

Also Feagin, Orum and Sjoberg, 1991 in Tellis (1997) stated that case study methodology was an ideal tool for research when a holistic and in-depth study was required.

The schedule and plan put together for the study involved a one day visit to the institutions, to enable the researcher carry out a site based analysis of e-learning spaces, identify best practice designs good examples, and understand the unique individual project strategy used for the delivery of such spaces. During this time interviews with the users of such spaces were conducted in order to obtain information on various user patterns and design requirement.

This exercise enabled the collection of important first hand data as part of the qualitative outcomes of the research. Prior to the site visits, in accordance to university standards, ethics approval was obtained along with authorisation from the institutions involved. The guidelines for the type of questions asked used during the visits is also presented below.

6.9.3.1 Case Study Selection Criteria and Structure

The selection criteria developed were three. These were based on the technology use and infrastructure within the learning spaces, the e-learning space design research focus and the space types identified earlier on.

I. Criterion One: - The Technology use and Adaptation within the Design of E-learning Spaces

The first criteria for the selection of case studies documented in this study were based on the technology use and adaptation within the design of the learning spaces. Therefore the study attempted to identify successful examples of technology rich learning spaces that could show case the effective and innovative marriage of technology and design within the physical learning environment.

II. Criterion Two: - E-Learning Space Design Research Focus

The second criterion used in the selection of case studies was based on the research focus which was outlined from literature? from the onset of the study as:

a. The impact of e-learning on facilities and design

b. The design of future spaces and how we get there

c. The impact of blended learning on the design of spaces

d. Designing for the learn anytime, anywhere paradigm

e. The security issues of e-learning and e-learning space design, and

f. The levels of design risk in an e-learning infrastructure and also

g. inclusive design and its future direction

The field work study therefore looked for case studies that reflected some of these aspects in the design of its technology rich learning environment as it was deemed appropriate to investigate spaces which would enable the researcher identify good examples of space design with regards to the above variables while attempting to find answers to the related research questions.

The reason for selecting this as second criteria for case study selection is based on the research expectation that this practical examples seen would also assist in providing solutions to the problems identified with regards to e-learning space design in higher education institutions which were mentioned in chapter one.

III. Criterion Three: - Type of Space Identified within HEI Campuses

Thirdly another criteria for case study selection was based on the type of space types identified across the HEI sector during the desk studies which were listed in chapter one and reviewed in chapter three. These were: - Group teaching/learning space; Simulated/special learning environments; Immersive environments; Peer-to-peer and social learning; Learning clusters; Individual spaces and External spaces.

The above selection criteria was chosen because it is directly related to the architectural configuration of the type of spaces in an HEI and can be easily identified in most cases also this being a broad criteria that will enable the researcher identify where the architecture and design of spaces exhibits a move towards intelligent building design as well as innovative use of space in the overall design concept of the technology rich learning space.

IV. Case Study Guidelines for Questions Asked

In addition to the criteria listed above some guidelines were also set out during the data gathering process for the research into good examples of E-learning space design on campus. These structured guidelines are presented below and are referred to as the case study guidelines. These have been used to write up the case studies documented in this project.

Guideline 1) Background of Institution

- Name of Institution, design brief development, background and context
- Finance, Source, budget, facts & figures, stakeholders
- Design & project management team weather within as in in-house estates & facilities department staff or external contractors
- Type of technology use, open access wireless, IT/ equipment, communication
- What were the success factors?
- Project strategy adopted
- Architect; Designer or Visionaries (E-learning champion); consultants

Guideline 2) Type of construction:-

- New Build
- Refurbishment or Renovations
- Expansions or Extensions
- Conversions

Guideline 3) Description or type of space

- Teaching & Learning environment
- Vocational
- Social learning environment
- Blended learning
- Physical attribute
- Materials used

- Size
- Function of space, specialist, teaching, learning, social, blended learning
- Type of layout/space; open or closed learning areas
- Furniture- soft, hard, flexible, sustainable,

Guideline 4) Design, Purpose & function

- Why the design
- What were the drivers?
- Who was it for?
- How did the Budget considerations affect design outcome
- When was is completed, time, duration, constraints, delays etc
- Any changes, i.e. Variations in cost, use of materials, time and why?
- Security issues

Guideline 5) Identifying user's requirement;

Some of the questions asked were

- How were users involved in the design process?
- How has the learning space improved teaching and learning experience?
- Feedback before during and after (post occupancy)
- Survey results if any (NUS satisfaction survey 2006) etc

Guideline 6) Design outcomes

- Measurable outcomes e.g. increase in recruitment trend, better user spaces, and better learning outcomes?
- Lessons learnt. "If you knew what you know now, what would you have done differently"?
- Effective, Efficient or Disaster

Guideline 7) Conclusions & Recommendations

- Areas for future improvement and further research possibilities

- Summary in form of a rating table that will identify the best practice examples

6.9.3.2 Summary on Case studies

In line with the research objective, site based analysis and a case study of selected Institutions involving scheduled visits was conducted between November and December 2007. The dates and HEIs investigated are as tabulated below in Table 6.5

Table 6.5 Names of HEIs and Dates for Case Studies

Name of Institution	**Date Visited**
University of Loughborough -	5th November 2007
University of Wolverhampton -	10th November 2007
University of Northumbria -	13th November 2007
University of Leeds -	28th November 2007
University of Essex	3rd December 2007

In addition to the above, University Executives from two HEIs outside the UK were also invited to participate in an online survey (interview) in order to compare and understand what obtained elsewhere and later to provide validation. These were:-

a) Ajman University of Science and Technology, UAE

b) Massachusetts Institute of Technology, USA

6.9.4 The Questionnaire Survey

The postal questionnaire and personal face –to-face survey are two best methods of obtaining data from respondents (Naoum, 2003). According to Naoum, (2003), the postal is cheaper and universally adopted. The advantage of being able to give questionnaires to respondents personally is that the researcher can explain what the survey is about and in some cases the questionnaires can be completed immediately (Bell, 2005 and Denscombe 2007). However the risk of misinterpretation of data by the interviewer is possible in this case. Therefore for this study, the online, web-based electronic questionnaire survey method was developed and adopted for this research as it was considered to be less expensive and faster method than the other two. Additionally it allowed for easier analysis of data electronically.

6.9.4.1 Questionnaire Design and Structure

It is more difficult to produce a 'really good questionnaire than might be imagined. It requires discipline, in selection of questions, in question writing, in the design, piloting distribution and return of the questionnaires' Bell (2005) Furthermore, she suggested that a lot more consideration ought to be given to 'how responses will be analysed at the design stage not after the questionnaires have been returned'. With consideration for the research approach and method adopted, that of a mixed methods combining qualitative and quantitative research, the data required from the survey were quantitative, that is responses that can be analysed in a numeric/ descriptive manner. The questions asked were therefore structured, close ended questions that would produce specific responses from the respondents (Bell, 2005). A control was also included in the questionnaire structure to prevent people from responding more than once in order to eliminate repetition and inaccuracy in results. This was done in line with her advice that 'well-structured questions' will not cause so many difficulties at the analysis stage. The questions used in the questionnaire were presented in the following formats described by Bell (2005); lists, categories, ranking, quantity, grid and scale.

Pilot

The questionnaire was initially piloted to forum participants in the months of February, March and April of Year 1 of the study. This was a trial run (Bell, 2005) the responses obtained helped to show that the contents of the survey were appropriate for the enquiry.

Administration of questionnaire

The first time the actual survey was administered in November of the first year of the study, the response was very low (<30%) due to inadequate follow up such as frequent reminders. Therefore on the second attempt, the distribution of the survey was successfully administered online via e-mail containing the link to the electronic questionnaire and the online research group CNBR in order to speed up the process of delivery and response while saving time and cost. It was launched on 18th July 2010 and results were collected on 19th September 2010 (For duration of 8weeks).

Sampling

Random selections of participants were invited to complete the survey; to eliminate bias. And reminders were sent to them after every two weeks to encourage participation. Also a date was fixed for responses to be sent in. Table 6.6 below is a tabulation of the group of participants and how they were contacted as well as the expected number of responses, the actual responses obtained and the respective response rate calculated as well as the overall total response rate of the three groups of surveys administered.

Table 6.6 Survey Participants, Sample Size and Response Rate.

Type of participants	**Number contacted via university/personal e-mail**	**Number contacted via online groups (CNBR)**	**Expected number of response**	**Actual number of response obtained**	**Response rate in percentage (expected/actual)**
Students	50	50	35	16	45.71%
Staff	20	100	25	13	52%
Executives/Directors of Estates	20	50	5	4	80%
E-Learning/ Champions Designers/Architects	10	50	5	4	80%
Total	100	250	70	37	52.86%

6.9.4.2 The Design of Three Surveys

Haven determined the research aim; it was thought that the examination and consideration of the environment (space) and the people (users) within it were valuable in achieving this set goal. These two variables thus became the main focus of the study as they were considered to be the factors that would determine the research approach and method which evolved. The three surveys were not covered in the earlier pilot survey administered, the three categories of participants only became apparent after the pilot survey response was obtained as illustrated in figure 6.2.

Also it was thought that a combination of qualitative and quantitative approaches involving detailed analysis, observations and some sort of measurements/ categorisation of these variables i.e. the space and the users of the learning space was the most suitable method of inquiry. Therefore a mixed methods research approach was adopted from the onset as the data gathering framework and process began to evolve.

Just to recapitulate, from initial studies, three major categories of users of learning spaces were identified namely; a) staff, students/visitors and other stakeholders such as b) university executives, directors of estates and financiers as well as the c) designers or architects of such spaces. Seven space types were also identified; these were Group teaching/learning spaces, simulated/ specialised learning spaces, immersive environments, social and peer to peer learning spaces, learning clusters, individual spaces, and external spaces. Hence the idea of conducting a pilot survey and subsequently three surveys to gather all necessary data from the three user groups within the space types became a concept which was adopted as the research direction evolved.

As mentioned in section 6.1 above, the pilot survey was administered to forum participants who were made up of a combined group of staff, students and executives of universities and directors of estates in Higher Education Institutions as well as the architects, designers and e-learning champions involved in E-learning space design. After this data was collected and looked at it was obvious that three major group of players were identifiable and they ought to be investigated separately because their understanding and perception of the space design within their HEI were different and deserved to be represented adequately, this therefore brought about the evolution of the idea of three surveys.

-The first one to be administered to a combination of two user groups comprising of staff and students that work, teach and study within e-learning spaces in Higher Education Institutions in the UK.

-The second survey to be administered to University Executives, Directors of Estates and Financiers of Building Projects for Higher Education Institutions in the UK.

- And the third survey administered to the architects, designers and e-learning champions or initiators of e-learning space design in Higher Education Institutions within the UK (these may be personnel from within the universities, property development or management companies, or local authorities involved in university building construction) or

The three separate surveys also supported the concept of carrying out detailed investigation of the different space types identified. It was believed that all this space types could be seen in different HEIs across the UK and this thinking therefore led to the concept of conducting several case studies to cover all space types identified. Furthermore similar research conducted by JISC, CABE and SFC suggests that for a research of this nature, the investigation of various case studies usually reveals useful information which could not be gleaned from one singular case study or source.

The areas which the questions in the survey focused on were:-

- General questions such as age, gender etc.
- Flexible use of spaces
- Space design and design elements
- Technology use and uptake
- Furniture; Type & Arrangement
- Finance/Cost & Budgets
- Learner's requirements vs. learning patterns/outcomes
- Mixed use (Multifunctional) spaces vs. timetabling
- Issues associated with inclusive design and future of learning environments
- Security and risk associated with space design

6.9.4.3 Summary on Questionnaire Survey Development

The feedback from the focus groups was used to develop a pilot survey which was launched online. From this, a structured questionnaire survey was developed for further research. It was expected that this would be administered during the proposed site based visits/ case studies of HEI's or sometime after the visit. The target group being the users/students of the selected HEIs; the survey was posted online after ethics committee's approval had been obtained. This survey was first launched in November 2007 as the results from the pilot survey helped with modification. The first survey was sent to participating HEIs through the online link to a select user group in the 15 HEIs identified below. It was posted online as this was thought to be faster and the easiest way of facilitating the response rate. It is envisaged that an overall figure of between 100 - 150 respondents will participate in the study. At the end of the exercise only twenty-five respondents filled the survey.

6.9.5 The Semi- Structured Interviews.

Bell (2005) stated that 'preparation for interviews follows much the same procedures as for questionnaires.' whereby the researcher chooses a subject area, develops questions, determines the methods for analysis and makes arrangement for it to be piloted. Agreeing with this, Cohen (1976:82) in Bell (2005) stated that 'like fishing, interviewing is an activity requiring careful preparation, much patience, and considerable practice if the eventual reward is to be a worthwhile catch'.

6.9.5.1 The Interview Design and Structure

The interviews unlike the questionnaire were planned to obtain mainly qualitative data, therefore, the question design were semi-structured in nature to allow the interviewee express and explain their ideas and opinions; this also enabled the researcher identify what specific responses were given to questions asked by the particular interviewee (Bell, 2005 and Denscombe, 2007). The questions were carefully worded such that they were similar in focus to the questions in the survey. As stated by Naoum (2003) 'personal interviews were an important tool for collecting details and opinions' this enhanced the quality of the data obtained as it was made up of the individual's experience and perceptions about the subject area. The interviews were done alongside the case study visits and participants included students, staff, University executives and designers.

6.9.5.2 Summary on Semi- Structured Interview

The semi-structured interview of 10 interviewees has been carried out as well so as to obtain qualitative data from users' of e-learning spaces and designers/ others referred to as, project managers or persons that initiated the change (E-learning champions). The success of this data gathering approach was vital; therefore it was necessary to ask the right questions. Some of the questions asked where focused on the following areas:-

- The users' requirement and inputs to the space design vs. technology available and facilities provided

- User preferences within the space designed and flexible use of an e-learning environment

- The design strategy and what was the underlying pedagogy/teaching and learning culture of the HEI investigated

- The problems associated with the design, security and delivery of such infrastructure

- The people behind the change, why it was initiated and what others feel about it

- Funding sources, budget, completion time and quality.

- User training and measurable outcomes

- Lessons learnt and things to be avoided in future

Results: - From the interviews some of the interviewees expressed the opinion that collaboration or knowledge sharing between HEI was non-existent, with no information for benchmarking hence HEIs often relied on their in-house Estate and Development Staff to handle construction/design projects. They stated that the motivation for some HEIs who embarked on building /design projects was the lack of teaching and learning spaces. The results flagged this up as the major determinants for the execution of construction projects. Others were the availability of funding vs. the institutions' Estate & Development plan.

Also results obtained showed that the varied users' learning patterns were:

- Individual/private study patterns

- Group/ collaborative study patterns

- Social/blended learning patterns

- Mobile, web based/ online learning patterns

- Practical /tutorial learning patterns

- supported learning pattern (tutor support for student requiring additional help)

- Peer-to-peer learning patterns

6.10 CHAPTER SIX SUMMARY

This first section of the Chapter presented a general understanding about the research approach and methodology and how this was developed. It attempted to explain how the development process evolved based on consideration of various research approaches, and strategies. It began with the investigation of the suitability of the qualitative or quantitative analysis methods to the research enquiry, and then it presented an overview of different data gathering techniques, with respect to the two types of data required i.e. the qualitative and quantitative data. Also their advantages and disadvantages were discussed.

The various research techniques/data gathering tools considered and used during the study included; Grounded theory approach, case studies and surveys – interviews and questionnaires. The mixed method approach was considered within the context of eclectic studies as this was thought to be the most suitable methodology for the studies.

As stated at the beginning of this chapter, the overall research strategy was made up of a fact finding mixed method approach based on initial theories developed and grounded in the literature reviews, desk studies and forums which served as a precursor that informed the overall research direction. Thereafter, the initial findings were used to inform the site based analysis, interviews and case study investigations, questionnaire survey as well as descriptive analysis and some explanatory research that was done; also the process enabled the development of the likely steps and structure for interpretation and analysis of data as represented in the schematic diagram above; where the types of data/ different data gathering techniques used were identified as well as the basis for each, the method for analysing them as well as the inherent constructs (themes) that were analysed.

Section two of the chapter presented the idea and background to the field work that was done in this study. It explained how the research method adopted was used in achieving the outlined objectives. The design and structure of the focus groups, case study, questionnaire survey and interviews was also discussed. Some of the preliminary results obtained were also mentioned briefly. Detailed analyses of results obtained are presented in the subsequent chapters.

CHAPTER SEVEN PRESENTATION OF DATA/ USERS SURVEY

7.0 INTRODUCTION

Chapter Seven covers the presentation of data and analysis of findings. It is dedicated to the factors that were considered as the rationale behind the results presented, the discussion of some qualitative results obtained from the Forums, and the quantitative data outcomes from the pilot survey and the first questionnaire survey administered to the Users' (Staff and students); and how these covers the research focus, research hypothesis and research questions while chapter Eight presents the case study and interviews results. Chapter Nine covers the general analysis for the data from the second and third surveys administered to the Executives and Designers' respectively as well as the analysis of the case study in order to develop conclusions.

Therefore for clarity, the primary data and some results obtained were presented followed by discussions and summary of findings. This is in order to support the justification and validity of the study presented and the possibility of an innovative and novel approach to the proposed framework that was developed.

It was thought that it important to reiterate some words of caution which were useful and timely for this work. Cousin (2009) wrote:

> *'Firstly do not let the tail wag the dog- research methods are in the service of the researcher not vice versa. Treat rules about methods as guidelines which you can adapt, refine expand or trim'.* Cousin (2009:2) argued that however, '*that was not to suggest that anything goes'.* She referred to Coffey and Atkinson (1996:11) who objected that *"qualitative research can be done in a spirit of careless rapture".* Cousin (2009:2) affirmed that *'all research, qualitative or quantitative, has a strong craft dimension to it and this involves knowing some of the rules before throwing them away…'*

Secondly, heed the words of Denzin and Lincoln (2000:162):

> *"This is an age of emancipation; where we have been freed from the confines of a single regime of truth and from the habit of seeing the world in one colour"* Cousin, explained that '*while randomized control trials remain a gold standard for some researchers, particularly in the field of medical research, education studies has become a playground where no one methodology needs to hog the best swing.*

The good researcher knows how to play around with many possible approaches in a spirit of curiosity about what they can yield. In this "age of emancipation "this spirit promises to replace the immaturity of paradigm warfare"

7.1 THE BACKGROUND TO THE RESULTS

Cousin (2009:4) observed that both qualitative and quantitative research involved interpretation, though these might be of different degrees. Cousin (2009) writes that it is wise to take note of the words of Stake (1995:19) who wrote that *"Good research is not about good methods as much as it is about good thinking"*

Therefore the results presented here were obtained through different approaches as explained in chapter six, though the intention as Cousin (2009) noted was not 'to suggest that anything goes' but the researcher aimed to adopt an approach that combined Inductive and Grounded Theory methods at the onset in order to assist with theory building; the identification of a problem; definition of research questions and research hypothesis. The Mixed Method Research Approach was then adopted as it was found to be suitable for the systematic data collection that informed the process of achieving the research aim.

If we recall, the process undertaken to ensure that the results were checked and validated for credibility of the interpretations from the data collected has been discussed in section 6.1 of Chapter six. A statement about the ethical framework that shaped the research process was also included.

7.2 THE E- LEARNING SPACE DESIGN FORUMS

The aim was to obtain qualitative data which would be of significant benefit to the data gathering process and the development of the research direction The rationales behind the forums were as follows:-

It was thought that this important initiative will have far-reaching consequences for how the next generation of HE students interacts with their learning environment. By attending one of the days participants were expected to:

- help shape the design of the e-learning spaces of the future
- exchange ideas with colleagues across the region and make contacts with other experts in the field
- discuss and debate key issues and identify examples of best practice
- take away ideas to apply in their own practice.

The Forums include breakout sessions which covered: the aspects of the E-learning space design research focus outlined in chapter one. Data was captured by using a Dictaphone to record discussions, notes were taken as well, and a video camcorder was also used. (This was operated by the researcher and members of the supervisory team). The participants were also offered the chance to tour the University's own modern E-learning environments.

The process of organising this event involved developing an event check list); identifying a suitable sample frame (mainly staff, students and academics in HEI and designers of academic buildings within the HEI); contacting them via e-mails and telephone as well as through invitation letters to inform them about the aim of the forum (participants were requested to choose one of three dates based on their availability); establishing a communication and a follow up strategy such as acknowledgement letters sent by e-mail/post and telephone calls to the responses that were received.

The contacts made with the participating HEIs were further developed into an E-learning space design innovation circle and it was from these that the contacts for site-based analysis and case studies for the identification of good design best practice in HEIs was done; after the event participants were given a feedback form, (see appendix C) the responses were also valuable in informing the research. After the event, participants were invited to participate in a pilot survey which was developed and administered via an online web link to those who had consented to participate willing.

All participants were duly acknowledged and duly appreciated for their contribution to the outcome of this study. They were participants from HEFCE, HEDQF, HEA, JISC, UCISA, CISCO Systems and Godfrey Syrett, students and staff of HEIs which included Universities of Warwick, University of Reading, University of Essex, and UCE Birmingham, University of Newcastle, University of Wales Bangor, University of Cardiff, Leeds Metropolitan University, University of Wolverhampton and representatives of AUDE. Industry partners Alexi Marmot Associates, and the JISC-consultants on Learning Space Design.

I. February Forum : The first Forum held on the 22nd of February 2007 was regarded as a dry run as all the participants were from within the University HE community. It therefore served as a reference point for improvement on the subsequent two events; the one day event included breakout sessions in which views and opinions were exchanged. A summary of the transcript of discussions is presented below under the headings (a-g above).

II. March Forum: The March Forum was successfully held at MA 115 University of Wolverhampton, Wulfrun Street Wolverhampton on the 22nd of March 2007. In attendance were 12 participants from Universities of Newcastle, Cardiff, Wales Bangor, Leeds Metropolitan University, University of Warwick and the University of Wolverhampton. Board members of HEDQF were in attendance at the March and April events

There was a presentation on ‘The impact of blended learning on the design of learning environments’ by the University of Wolverhampton’s Ms Helen Gale (Associate Dean CELT) in other to help participants have a general understand the focus of the research. Also a presentation on the development and construction strategy of the University of Wolverhampton’s technology supported (E-learning) buildings was delivered by the Project Manager Mrs Angela Nash. This generally helped to open the discussion which took place afterwards; forum participants were given an opportunity to give brief talks on the progress made by their respective HEI’s in this regard.

A participant from University of Cardiff gave a presentation on the proposed building and redesigning of their Modern Learning Centre and the spoke about the problems with the existing old structure. A participant from University of Newcastle gave a presentation highlighting the type of furniture designs used within their learning environments while reiterating their need for assistance in procuring and designing better furniture. The participant from University of Wales Bangor, stated that they were there to learn and get ideas as their own HEI was about to embark on some new build projects. He stated that attendance of the forum afforded them the opportunity to learn from others and hopefully avoid mistakes. A participant from Leeds Metropolitan University also gave a brief talk on the progress made by their HEI in this regard. They were then conducted on a guided tour of the e-learning focused buildings and recent development within the University’s City campus.

III. April Forum

The 3rd Forum was held at the Arena Theatre, Seminar Room, Wulfrun Street Wolverhampton on the 26th of April 2007. The event was well attended, with 15 participants. The former Dean of the School of Engineering & Built Environment (SEBE) gave an opening talk; in which he stated that the design of e-learning spaces should not only incorporate limitless flexibility (i.e. adaptable, adjustable and multifunctional spaces) but should be personalised and customised; combining functionality and should be inspirational and focus on how to use the learning environment to achieve better performance.

The project manager and co-facilitator gave a presentation on the impact of good design of learning environments on the users within the University of Wolverhampton and its strategy for achieving a student-focused and flexible learning environment mixed with blended learning.

An Architect from Industry (representing Alexi Marmot Associates,) and an independent space designer /JISC consultant also gave presentations on e-learning construction projects within HEI's and the future of learning environments respectively.

Participants were then invited to express their views and opinions on good design of spaces within HEIs. The former Deputy Director of Estate from University of Essex, discussed the on-going building construction projects which would feature mixed-use buildings, to be let out to paying clients like ASDA-George, Consultants proposing a Dental Training Centre, GP Surgery and a Business Incubation Centre amidst the proposed School of Entrepreneurship and Business at the university situated in the city centre. This led to the expression of opinions and views on the risk and challenges posed by designing for e-learning environments.

The representative of HEFCE mentioned some key requirements expected once funding has been provided by HEFCE to HEIs' for building projects; such as assurance from HEI's on their ability to handle the responsibility of providing strategy that achieves student focused buildings and utilisation of HEFCE guidance on space management and sustainability to achieve collaboration between teaching and learning. He emphasised that HEFCE had a light-touch assurance based approach that allows for freedom and autonomy for HEIs' conducting their business with reduced regulation reviews.

7.2.1 The Results from the February Forum

(The responses from participants are represented in bold fonts)

<u>a) 'The impact of E-learning on facilities and design'</u>

A participant noted that with respect to the teaching and learning spaces his opinion was that its use was:-

- **'Limited by the mobility of the equipment'**
- **'Design of furniture and facilities within the space'**

b) 'The design of future spaces and how we get there'

The participants' comments were as follows:-

- **'Any process needs to be interactive; A gradual transition'**
- **'Adaptable, adjustable and multifunctional – flexibility in design. Personalisation is important – taking the people with you.'**
- **'Future use of space is governed by how students use and will use the space – can you design for a future that is unknown'**
- **'Buildings should have capabilities for the use of future technologies – use of functionality into different facilities and areas.'**
- **'Adapt the space to the technologies available'**
- **'Think lab at Salford University – is a good example as well as 'The Box at LSE'**
- **'Open spaces help with social issues'**
- **'If everything is open space why don't academics want open plan?'**
- **'Cultural - academics are used to closed areas. Age plays a part.'**
- **'Is open planning just a fashion? There is probably no answer.'**
- **'Bridging the gap between those that impose an architectural solution with the wishes and requirements of the user. This is a fine line – are we designing for now of for the future.'**
- **'Allow for progressive flexibility that is maintainable.'**
- **What happens to the spaces between the buildings?**
- **Sustainability? Is it about the Buildings or the Planet!**

Other participants added their opinions about

c) The impact of blended learning on the design of spaces

d) Designing for the learn anytime, anywhere paradigm

Some of the participants observed the following-

- **'The lack of adequate training for end users of facilities made the impact less'**
- **'Useless spaces – do you create a box therefore what is a space?'**
- **'Space or facilities – space is m2; functionality is what we use the space for.'**
- **'Preference of using open spaces'** was highlighted as well as the perceived constraints such as:-
    - Noise
    - Concentration
    - Security
- Participants agreed that **'information technology could enable space or disable space'**

7.2.2 Results from the March and April Forums

The participants observed the following-

- **'Flexibility of furniture/ design and procurement of furniture in e-learning spaces'**
- **That there were concerns about 'the type of furniture designs used within learning environments/ the need for assistance in procuring and designing better furniture.'**

<u>c) The impact of blended learning on the design of learning environments</u>

Was directly related to

- **'The development and construction strategy of the University the building' and that in the process of 'redesigning of a Modern Learning Centre/ the problems with the existing old structure' ought to be investigated before commencing.**

Another participant mentioned that with respect to

<u>d) Designing for the learn anytime, anywhere paradigm</u>

- **'There was an opportunity to learn and get ideas' and the need to provide**
- **'Guidance for HEI who were about to embark on some new build projects'. As well as**
- **'The opportunity to learn from others and hopefully avoid mistakes'.**

It was also stated that

- **‘The design of e-learning spaces should not only incorporate limitless flexibility (i.e. adaptable, adjustable and multifunctional spaces) but should be personalised and customised; combining functionality and should be inspirational and focus on how to use the learning environment to achieve better performance’.**

A participant mentioned that there was definitely a connection between

‘**The impact of good design of learning environments on the users within the University’ and**

- **‘Strategy for achieving a student-focused and flexible learning environment mixed with blended learning’ as well as**
- **‘Types of e-learning construction projects within HEI’s’**

The thoughts expressed about the future of learning environments were based on examples discussed about on-going building construction projects. It was generally thought that in future HEI buildings would have features such as-

- Mixed-use buildings, with let spaces for paying clients and a Business Incubation Centre amidst the proposed learning environment.

The participants agreed that ‘**there was a need to consider,**

<u>e) The security issues of e-learning and e-learning space design, and</u>
<u>f) The levels of design risk in an e-learning infrastructure</u>

It was observed that there were huge **‘risk and challenges posed by designing for users of e-learning environments.’**

In response the participant from HEFCE mentioned that there were **‘key HEFCE requirements from funded HEIs for building projects; such as assurance on ability to handle the responsibility of providing strategy that achieves student focused buildings; utilisation of HEFCE guidance on space management and sustainability and the need to achieve collaboration between teaching and learning’.**

7.2.3 Summary of Findings from the Forums

The following is a summary of the findings from the forums:-

- It was thought that the impact of e-learning on facilities and space design was limited by the mobility of the equipment’ and ‘design of furniture and facilities within the space’ the impact was also said to be limited by ‘the lack of adequate training for end users of facilities’. It was argued that often the creation of ‘useless spaces’ occurred; it was an expectation that ‘functionality is what we use the space for’; for some the concept of open planning was a preference while for others the constraints of ‘noise, lack of concentration and security was a concern. Participants agreed that ‘information technology could enable space or disable space’

- It was expressed that the ‘flexibility of furniture/ design and procurement of furniture in e-learning spaces’ also had an impact on space design and learning outcomes and that there were concerns about ‘the type of furniture designs used within learning environments/ the need for assistance in procuring and designing better furniture.’

-The impact of blended learning on the design of learning environments was thought to be related to ‘the development and construction strategy of the University’

- It was stated that in the process of ‘redesigning a building, ‘the problems with the existing/ old structure’ ought to be investigated before commencement of the project.

- It was opined that in designing for the-learn anytime, anywhere paradigm, ‘there was an opportunity to learn and get ideas’ as well as the need to provide ‘guidance for HEI who were about to embark on some new build projects’. It was thought that this will help them to ‘hopefully avoid mistakes’.

- It was also stated that ‘the design of e-learning spaces should not only incorporate limitless flexibility (i.e. adaptable, adjustable and multifunctional spaces) but should be personalised and customised; combining functionality and should be inspirational and focus on how to use the learning environment to achieve better performance’.

- It was thought that there was ‘definitely a connection between the impact of good design of learning environments on the users within the University’ and the university’s ‘strategy for achieving a student-focused and flexible learning environment mixed with blended learning’ as well as the ‘types of e-learning construction projects within HEI’s’

- The future of e-learning spaces and how we get there; in future HEI buildings would incorporate mixed-use spaces, amidst the learning environment.

- It was observed that consideration of ‘the security issues of e-learning and e-learning space design, as well as ‘the levels of design risk in an e-learning infrastructure’ was required. As there ‘were huge risk and challenges posed by designing for e-learning environments.’

- The HEFCE key requirements from the projects they funded were; ‘ability to handle the responsibility of providing strategy that achieves student focused buildings; utilisation of HEFCE guidance on space management and sustainability and the need to achieve collaboration between teaching and learning’.

7.3 THE PILOT SURVEY

After the Focus group, a pilot questionnaire survey was developed based on the qualitative data gathered from the desk studies and Forums. It was administered to forum participants who had indicated their willingness to participate. The pilot survey aimed to check whether the questionnaire design and structure as well as the questions were appropriate to the research inquiry. Respondents were staff and students of the university; mainly from the field of Engineering and the Built Environment as well as Law and the Centre for Teaching and Learning.

A total of fifteen people were contacted from the list of 33 participants from different HEIs. Twelve of them responded. The questionnaire was divided into three sections, made up of ten close ended questions.

7.3.1 The Results from the Pilot Survey

The data obtained were general data, use of e-learning spaces/facilities, user involvement in the different types of space design and users understanding of space design and its impact on their learning outcome. The response indicated that the activities carried out within their learning environment were varied; such as quiet study, browsing the web, checking e-mails, collaborative studies, networking, participation in tutorials or practical demonstrations, research and teaching/learning. Majority of them thought that the Functionality, Aesthetics and Innovative use of space within their e-learning environment was good enough, satisfactory or fair. Their understanding of an e-learning space was that it incorporated teaching and learning facilities as well as IT and allowed for social interaction as well as collaborative studies. Majority of respondents indicated that they had not been involved with the design/construction of the e-learning facilities provided. Table 7.1 below is a tabulation of the some of the feedback obtained from the pilot survey.

TABLE 7.1 Summary of Some Feedback from the Pilot Survey

Questions	**Survey Member 1**	**Survey Member 2**	**Survey Member 3**	**Survey Member 4**	**Survey Member 5**	**Survey Member 6**
1. Staff or student?	Student	Staff	Staff	Staff	Staff	Student
2. Field of specialty/study?	Law	Construction Project Management	Engineering	CELT	Management Staff	Engineering /Built Environment
3. Activities done within your teaching and learning environment	Participate in collaborative teaching & learning	Participate in tutorials and practical training sessions	Access online teaching and studying materials	Carry out presentations	Conduct research work, analysis or experiments	Check emails and surf the web Undertake quiet study
4. what do you understand by an e-learning space	A space that incorporates social activities with informal learning facilities like a cyber café for blended learning	A space fitted with flexible furniture, IT and technology for multipurpose usage	A space that has been fitted with IT facilities, digital technology and media for teaching & learning	Learning through online (virtual) facilities only e.g. long distance learning	A space that has been fitted with technology supported learning facilities with inclusive design consideration for ease of accessibility and usage by all	A space that incorporates social activities with informal learning facilities like a cyber café for blended learning
5.Opinion about: Functionality 1- very good, 2- fair, 3- satisfactory or 4- poor	3- satisfactory	1-very good	2-fair	2-fair	3- satisfactory	2-fair
6. Aesthetic quality 1-very good, 2-fair, 3- satisfactory or 4- poor	2-fair	3- satisfactory	3- satisfactory	3- satisfactory	3- satisfactory	2-fair
7. Innovative use of space 1- very good, 2- fair, 3- satisfactory or 4- poor	3- satisfactory	2-fair	1-very good	3- satisfactory	3- satisfactory	2-fair

8. what type of spaces and furniture layout do you prefer e.g. open spaces, flexible furniture, closed spaces, fixed furniture	Flexible furniture, and open space plan arrangement	Enclosed space plans (i.e. with walls or glass partitioned areas)	open spaces, flexible furniture arrangement to allow for multipurpose use	Enclosed spaces and fixed furniture arrangement to allow for formal teaching and learning	Spaces fitted with good lightening, ventilation and acoustics to absorb sound during collaborative learning	Flexible furniture, and open space plan arrangement
9. Do you think that the space design of the teaching and learning environment has improved your teaching and learning experience, where (1) strongly agree and (4) strongly disagree	2- Agree	2-Agree	2-Agree	2-Agree	2-Agree	2-Agree
10. As a user, was your opinion sought about the design of the teaching and learning environment provided during the design process or during the construction stage?	No	No	no	no	yes	no

7.4 THE QUESTIONNAIRE DATA

The questionnaire data collected were from three groups i)the users of the e-learning spaces i.e. staff and students, ii)the executives and iii) the architects/designers. The raw data obtained are presented below.

The first group of questionnaire data was obtained from the users of e-learning spaces.

The main objective of the Users' survey was to identify users' perception of theoretical and technical issues of designing an e-learning space (technology supported learning environment); users' level of involvement in its design and construction if any, as well as their awareness of possible improvement on the design and management of the said environment.

Question 1-8 were generic questions aimed at obtaining a general background understanding about the type of respondents (staff and students) within the HEIs. This section will produce results about the age group, area of specialization, physical ability or disability, years of staff experience and mode of study as well as the gender of respondents.

Question 9 was based on the use of E-learning facilities.

Question 10-15 were based on space design of the e-learning environment in order to understand users' perception of the term an 'e-learning space' and design elements such as functionality, aesthetic quality and innovative use of space as well as their preferences of the different space design layouts achievable and if these have improved their teaching and learning outcomes

7.4.1 Users Survey Responses and Descriptive Analysis

The characteristics of the participants, how they were contacted, the sampling size and response rate have been discussed in chapter six this section therefore presents only the responses and descriptive analysis of the users' survey in the form of tables and charts.

General Questions Q1-Q8

Q1 what user group do you belong to? (Please tick as appropriate)

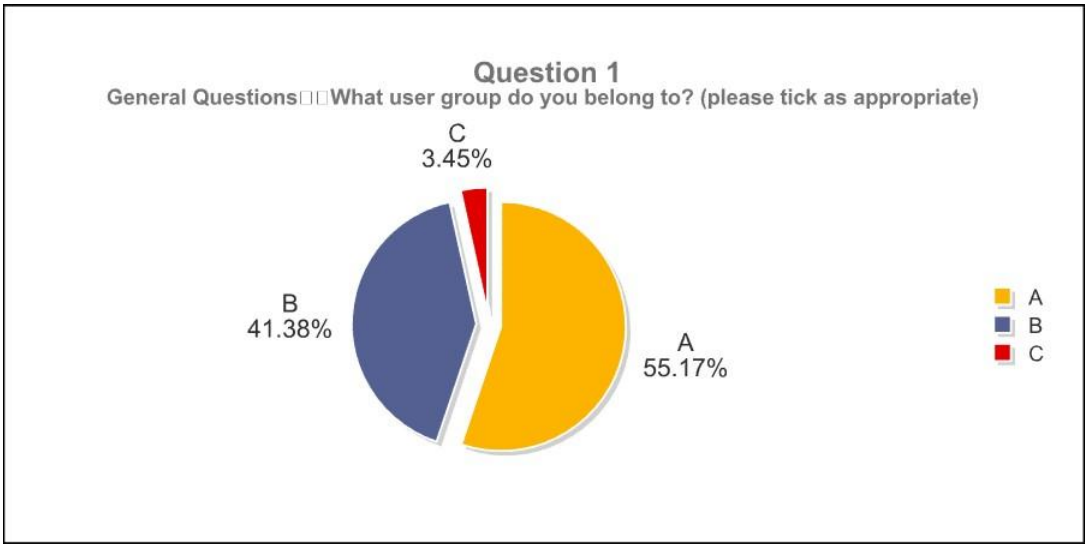


Figure 7.1 Response to User Groups

Figure 7.1 indicates that 55.17% (16) of the survey respondents were students while 41.38% (12) were staff and 3.45% (1 person) was a consultant. A total of 29 responses were obtained.

Q2 If you are a staff, please what category do you belong to? Question two aimed at obtaining more information about the type of staff respondents. They were made up of 6 teaching staff, 2 administrative staff, 4 research staff and 10 persons selected the N/A option which may imply that they were students. A further response obtained by 7 persons who selected the other option showed that; 1 was a management staff and 1person was a consultant while the remaining 5 were students. Therefore, it can be understood that a total of twelve staff participated which helps to verify the response given to question one above in which twelve (12) respondents indicated that they were staff and 16 indicated that they were students. Figure 7.2 shows the percentage distribution of staff categories.

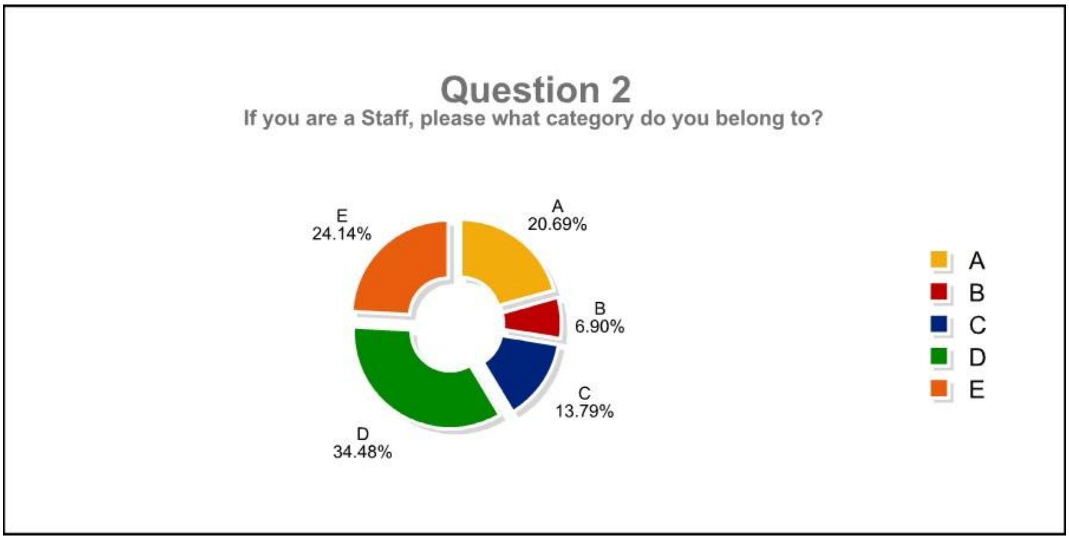


Figure 7.2. Percentage Distribution of Staff Categories.

Q3 How many years of experience do you have as a Staff? (Please select N/A if you are not a Staff) Question three indicated the years of experience of the twelve respondents. One had less than two years while eleven respondents had over 2yrs. seventeen people indicated that this question was not applicable to them (it can be assumed that they were the students and consultant and management staff as indicated in question one. Figure 7.3 is an illustration of the response.

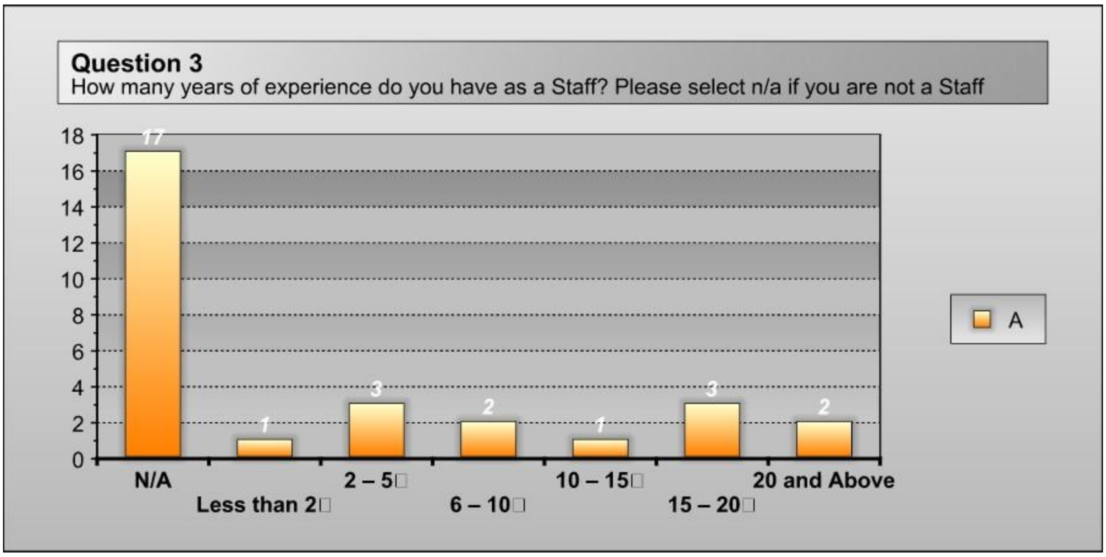


Figure 7.3 Years of Experience of Staff Respondents.

Q4 If you are a Student, what is your mode of study? (Please select N/A if you are not a student)

The responses indicated that 20 people were fulltime students while 8 selected the N/A option (these could be assumed to be staff) while the other response from one person was “I am a lecturer.” The results suggest that about four people were also staff members as well as students hence the increase in number from 16 students to 20 who indicated that they studied on the full time mode. Or it could be that the 4 people selected full time as the mode of teaching. Figure 7.4 is a representation of the data explained.

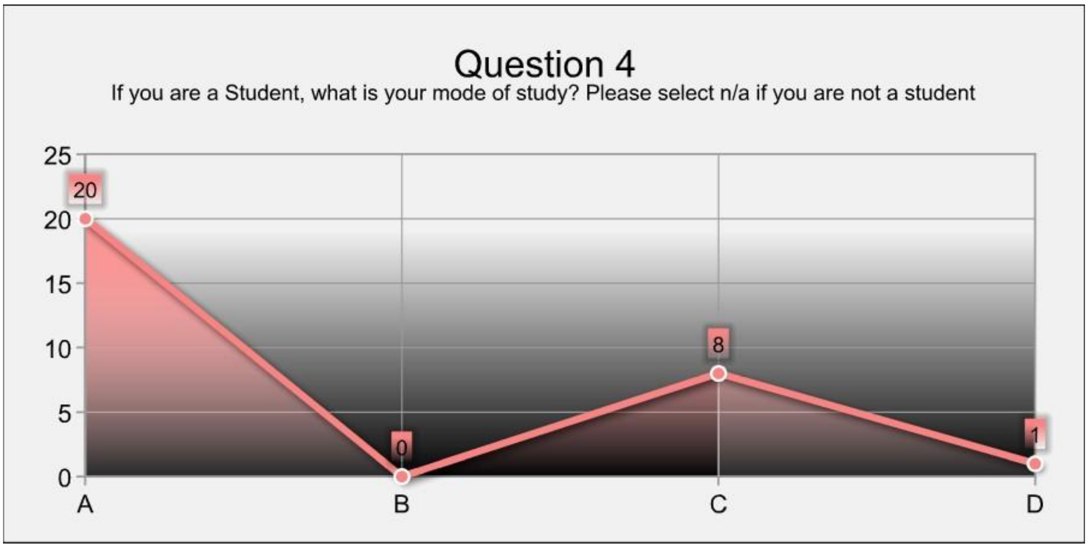


Figure 7.4, The Distribution of Students’ Mode of Study.

Q5 What is your age group?

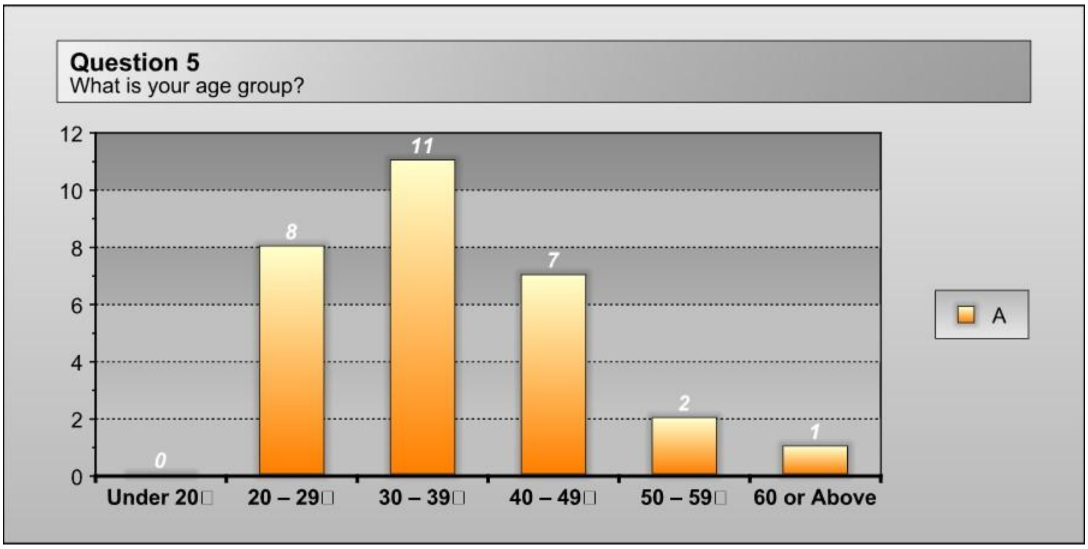


Figure 7.5- Age Distribution of Respondents

For question five, the data obtained showed that none of the respondents was below

20years; most were between ages 20-29 and 40-49. While two were between ages 50-59 and 1 person was 60years or above. This therefore suggests that most of the staff and students respondents were matured as represented in the figure 7.5.

Q6 What is your field of speciality/study? (respondents were required to select from a list)

The results obtained for the question on the area/field of speciality of respondents; Those who selected other indicated that their specialities were 1) Built Environment, 2) Structural Engineering, 3) Construction, 4) Construction economics, 5) Project Controls & Management, 6) CEM, 7) Engineering Education, 8) Construction Project Management (these can be assumed to be under the field of Engineering and the built environment). The others were 9) Technology support for learning, and 10) Business information technology. This could be grouped under Computing and IT.

Figure 7.6 is an area chart; descriptive representation of the responses provided.

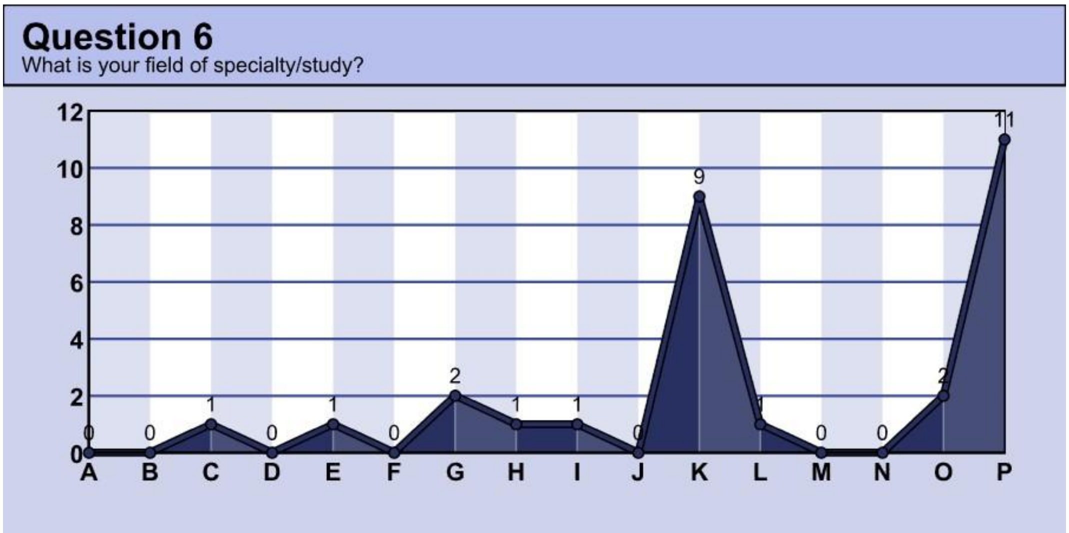


Figure 7.6 Areas of Speciality of Respondents.

Q7 What is your gender?

The results indicated that 16 respondents were male and 13 were female as shown in Fig 7.7.

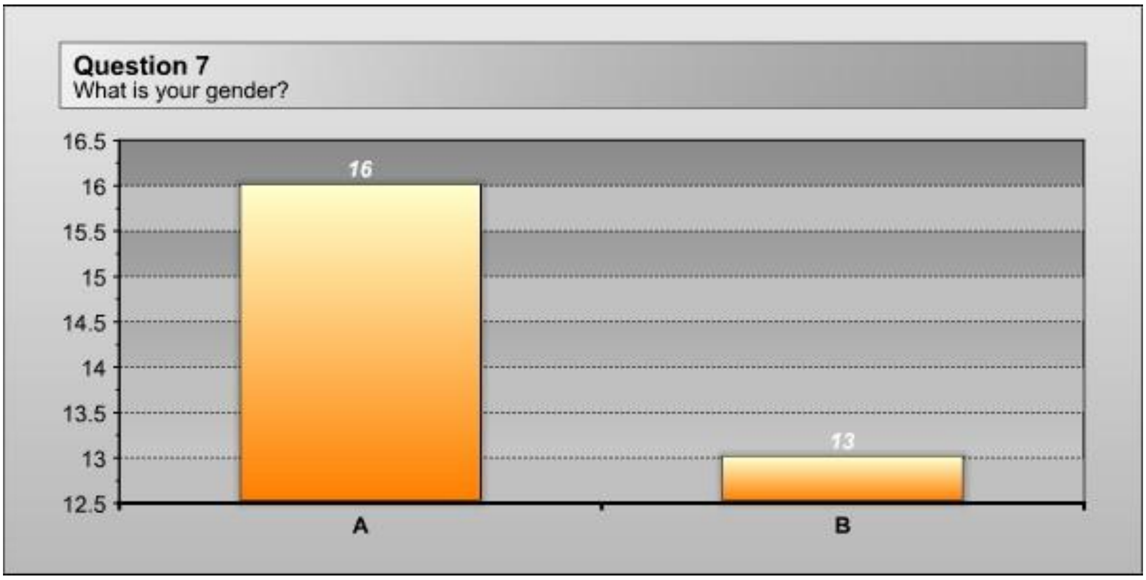


Figure 7.7 Male To Female Ratio of Respondents

Q8 Would you consider yourself as having any form of disability or medical condition requiring medical assistance?

The response received showed that 96.6% (28 respondents) said No while 3.4% (1 person). Figure 7.8 represents this information.

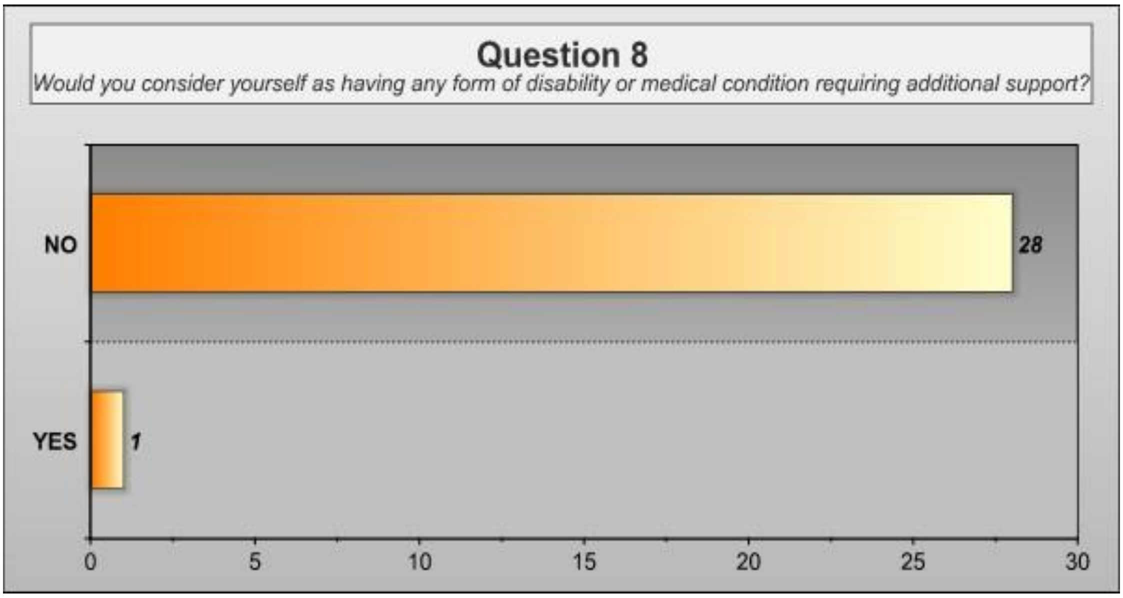


Figure. 7.8 Bar Chart of Disability of Respondents

Summary of the demographic/general questions Q1-Q8

- Students to staff ratio indicated that 55.17% (16) of the survey respondents were students while 41.38% (12) were staff and 3.45% (1 person) was a consultant. Therefore there were more students than staff respondents in the overall survey.

- The type of staff respondents; majority of the staff were teaching staff (6no), while 2no indicated that they were administrative staff, 4no research staff. A further response obtained by 7 persons who selected the other option showed that; 1 was a management staff and 1person was a consultant while the remaining 5 were students

-Staff level of experience; 1 staff respondent had less than two years while the remaining 11 respondents indicated that they had over 2yrs working experience.

-Mode of Study; the responses indicated that 20 people were fulltime students while 8 selected the N/A option (these could be assumed to be staff) while the other response from one person was “I am a lecturer.” The results suggest that about four people were also staff members as well as students hence the increase in number from 16 students to 20 who indicated that they studied on the full time mode. It could also be assumed that the 4 people selected full time as their mode of teaching.

-Age distribution; The data showed that none of the respondents was below 20years; most were between ages 20-29 and 40-49. While two were between ages 50-59 and 1 person was 60years or above. This therefore suggests that most of the staff and students were matured

- The area/field of speciality of respondents; most of the survey respondents were from the Built Environment and Engineering, while the other respondents indicated that their area of speciality were Technology support for learning, and Business information technology.

- The Gender ratio from the results indicated that 16 respondents were male and 13 were female. Therefore there were more male respondents than there were female.

- Ability/disability levels; the response obtained indicated that 96.6% (28 respondents) said No while 3.4% (1 person) said yes, therefore only one out of the twenty –nine respondents was disabled.

The following questions were on the ‘Use of E-Learning Facilities’

Q9 The teaching and learning facilities provided enables me to-

(Please grade in order of priority where (1) is the lowest and (5) is the highest)

The result of the priority rating of what the teaching and learning facilities enables users' to do within the e- learning environment indicated that 37.93% (11 people) rated participation in collaborative teaching and learning, as well as the ability to access online studying materials as '5' which is the highest priority; while 55.17% (16 people) rated the checking of e-mails and surfing the web highly as well which suggests that this was a priority to most participants compared to using the facilities for quiet study which was rated '3' by 37.93% (11 people) which is an average priority rating. Another activity rated high was the ability to conduct research work, analysis or experiments- 41.38% (12 people). The activity with the least score on the rating was the ability to carry out presentations which was rated '3, 4 and 5' by 31.03% (9people) respectively. While the participation in tutorials and training sessions was rated '3' by 31.03% (9 people) was also given an average priority rating. Figures 7.9a-7.9g were the graphic representations of the results obtained.

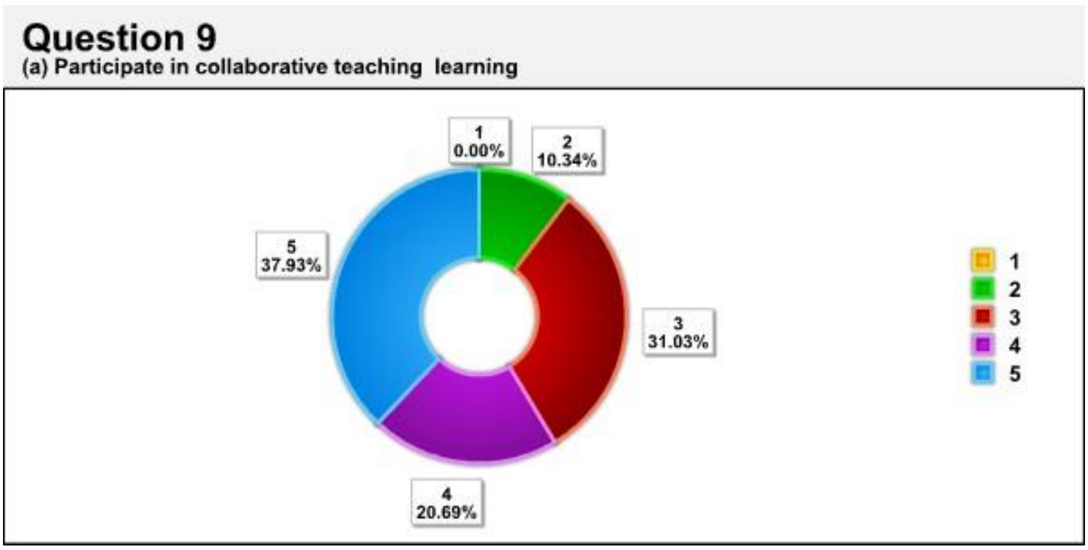


Figure 7.9a, Participation in Collaborative Teaching and Learning Rated Highest by 37.93% (11 people)

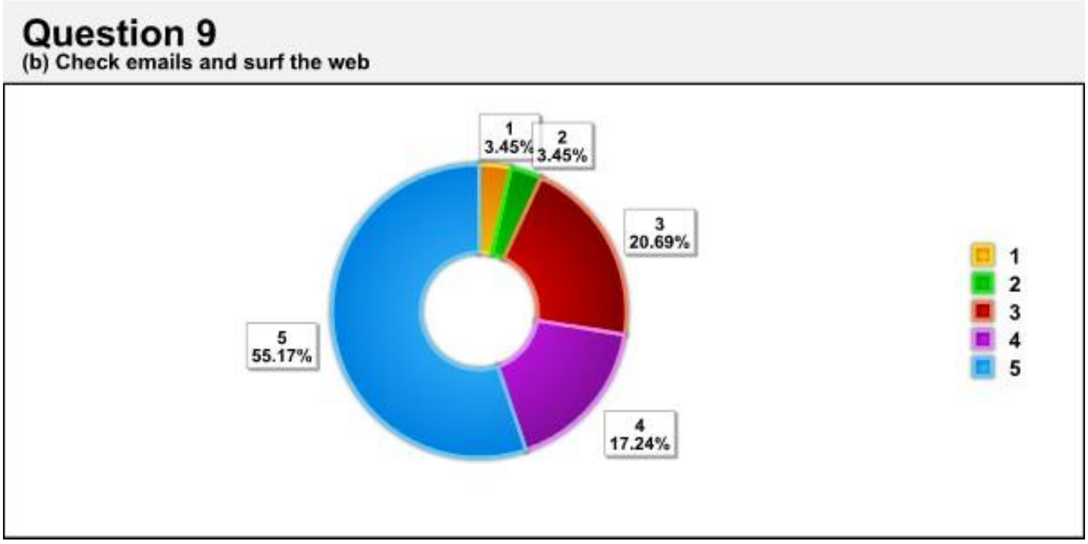


Figure 7.9b, Rating of Checking E-mails and Surfing the Web As Highest Priority by 55.17% (16 people).

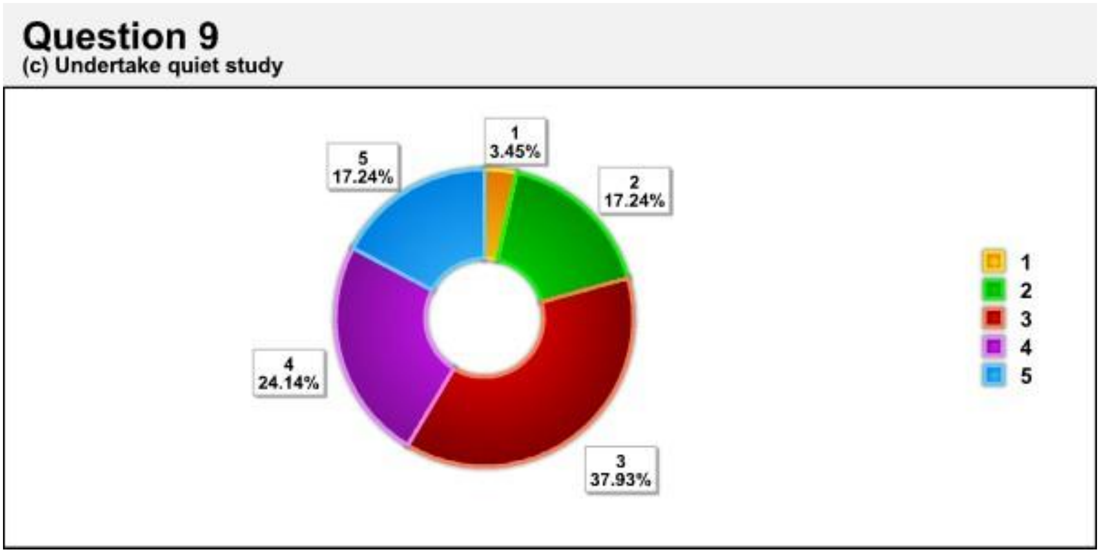


Figure 7.9c. Rating of Quiet Study As An Average Priority by 37.93% (11 people)

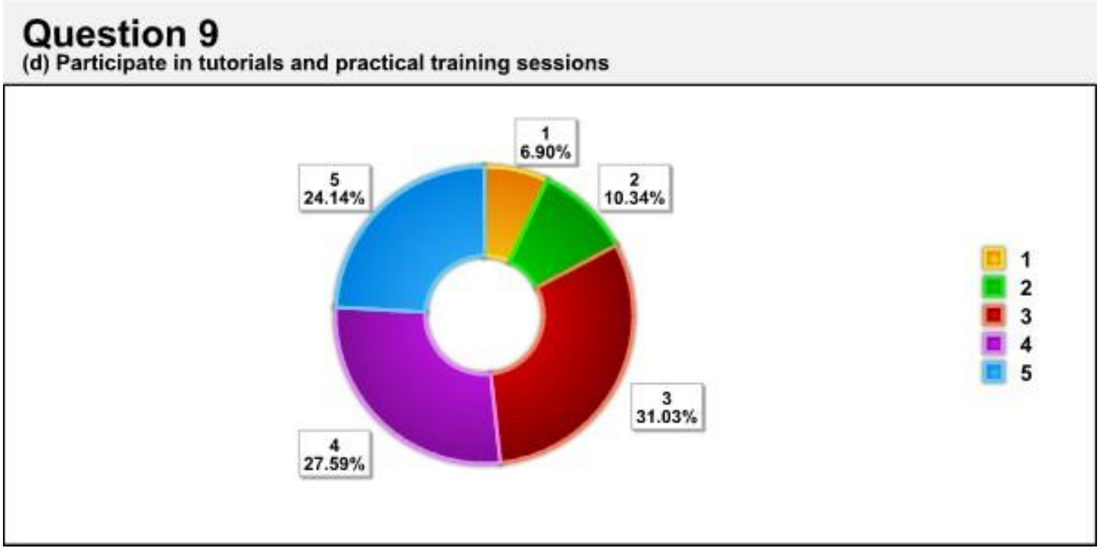


Figure 7.9d. Average Priority Rating to Participation in Tutorials and Practical Training Sessions by 31.03% (9 people)

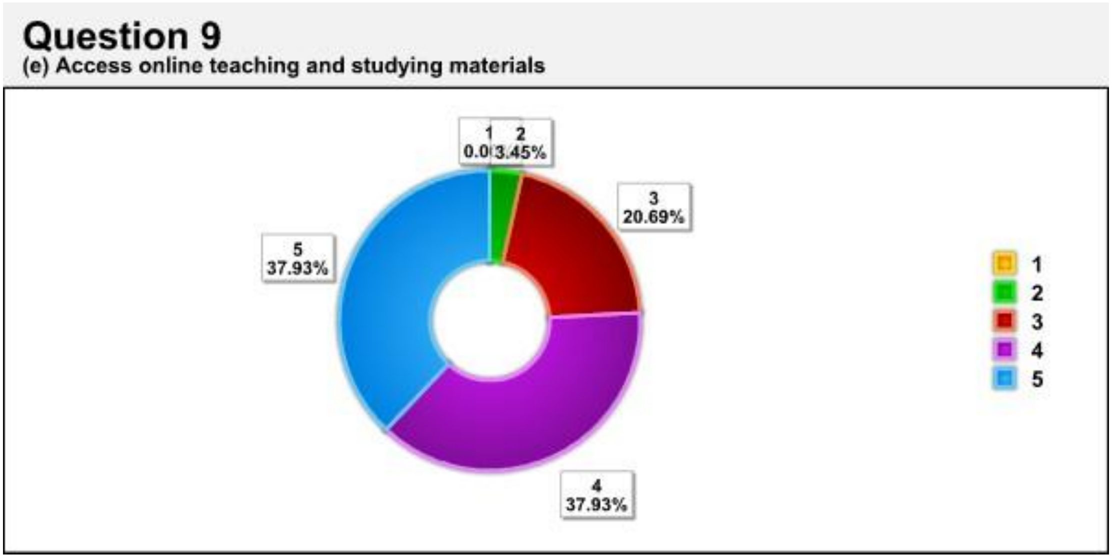


Figure 7.9e. Accessing Online Teaching and Studying Materials As Highest Priority by 37.93% (11people)

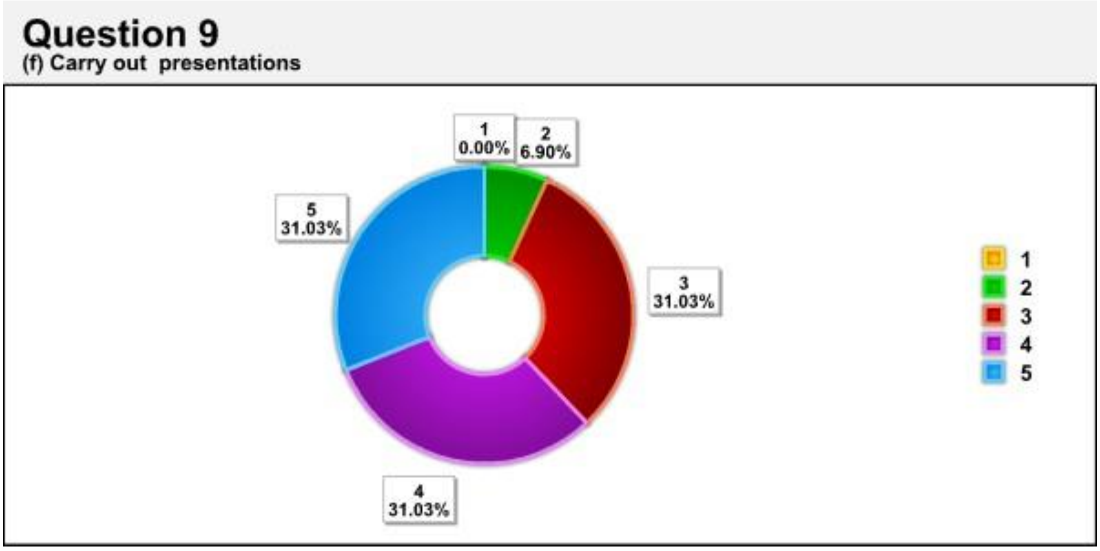


Figure 7.9f. Carrying out Presentations Rated As High Priority by 31.03% (9people).

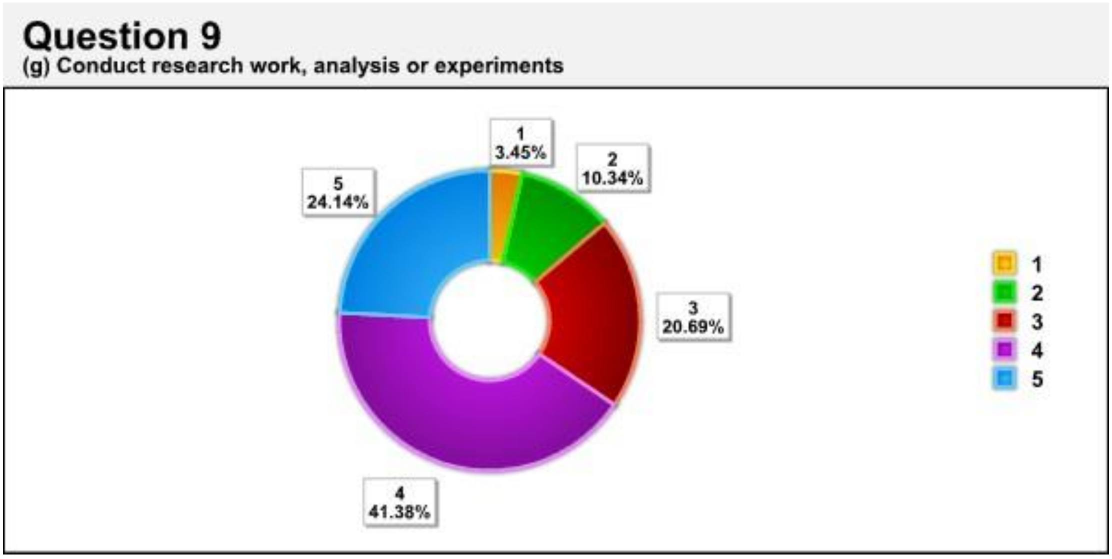


Figure 7.9g. Conducting Research Work, Analysis or Experiments As A High Priority as Rated by 41.38% (12 people).

The following sets of questions (10-15) were on 'Space design' and its impact on teaching and learning outcome.

Q10 Which of the following do you understand by the term 'an e-learning space or technology supported learning environment'? Please select all that apply.

The results obtained indicates that 30.6% (22 people) selected option 'C'; A space that has been fitted with technology supported learning facilities with inclusive design consideration for ease of accessibility and usage by all. This information is represented in the figure 7.10

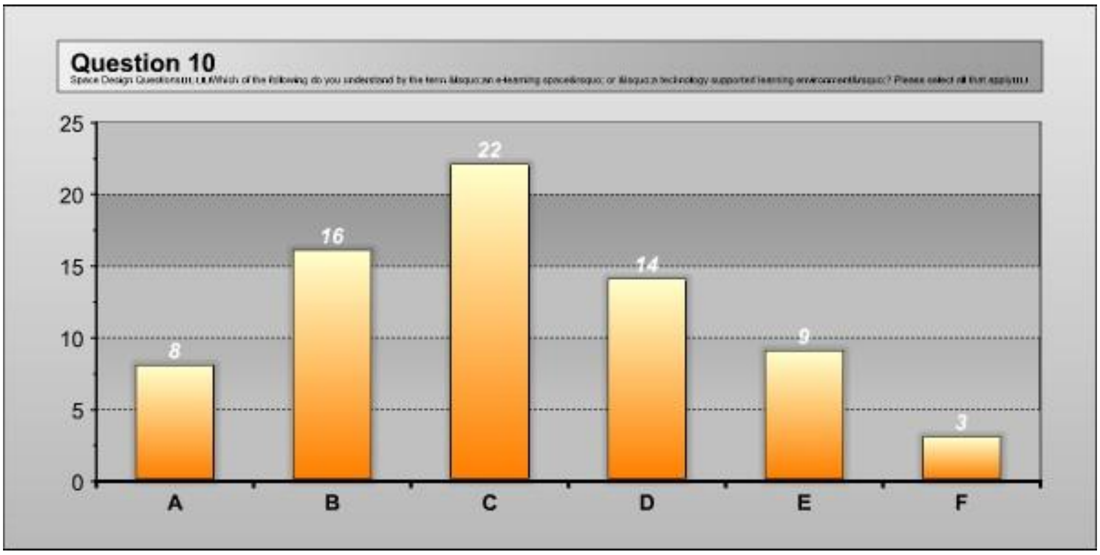


Figure. 7.10 Users Understanding of An E- Learning Space Design.

Figure 7.10 is a the bar chart that indicates that 22 people selected option ‘C’ – ‘A space that has been fitted with technology supported learning facilities with inclusive design consideration for ease of accessibility and usage by all’ to be their understanding of what an e-learning space means.

While 3 people had other definitions which were as follows:-

‘An interactive studio’; facilities for distance learning e.g. video conferencing’ and ‘A combination of virtual space and physical space with facilities for both face to face and virtual contact for collaboration, sharing and using digital resources’.

Q11) As an end user, what is your opinion of the overall space design of the teaching and learning facilities of your institution, within the parameters of functionality, aesthetic quality and innovative use of space? (Please tick where 1 is very good (4) is poor)

The response as illustrated in figure 7.11 indicates that 41.38% (12 people) considered that the functionality was very good ‘1’ an additional 37.93% (11 people) felt that it was fair, ‘2’ while 20.69% (6 people) felt that it was satisfactory. It can be seen that all 29 respondents considered the functionality to be satisfactory, fair or very good. No one felt that it was poor.

The result for the aesthetic quality showed that 48.28% (14 people) considered this to be fair. It can be seen that the greater number of 26 respondents considered the aesthetic quality to be satisfactory, fair or very good while 3 respondents considered that it was poor.

On the innovative use of space, the results obtained showed that 34.48% (10 people) considered theirs to be very good and the greater number, 27 respondents considered the innovative use of space to be satisfactory, fair or very good while 2 respondents considered theirs to be poor.

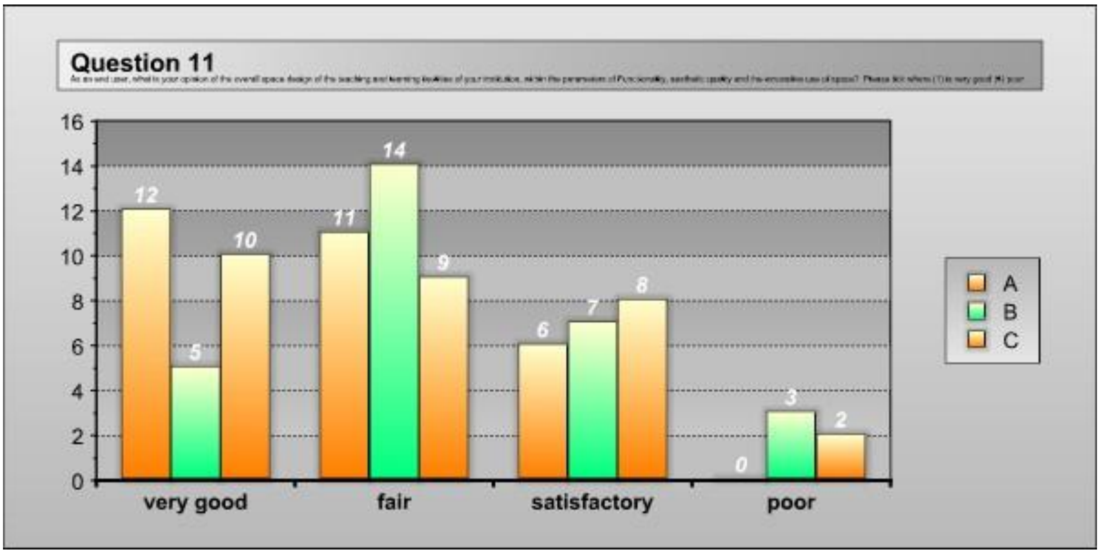


Figure 7.11 Users' Response To Design Parameters

The above chart is further separated into the functionality rating, in figure 7.11a, aesthetic quality in figure 7.11b and innovative use of space in figure 7.11c.

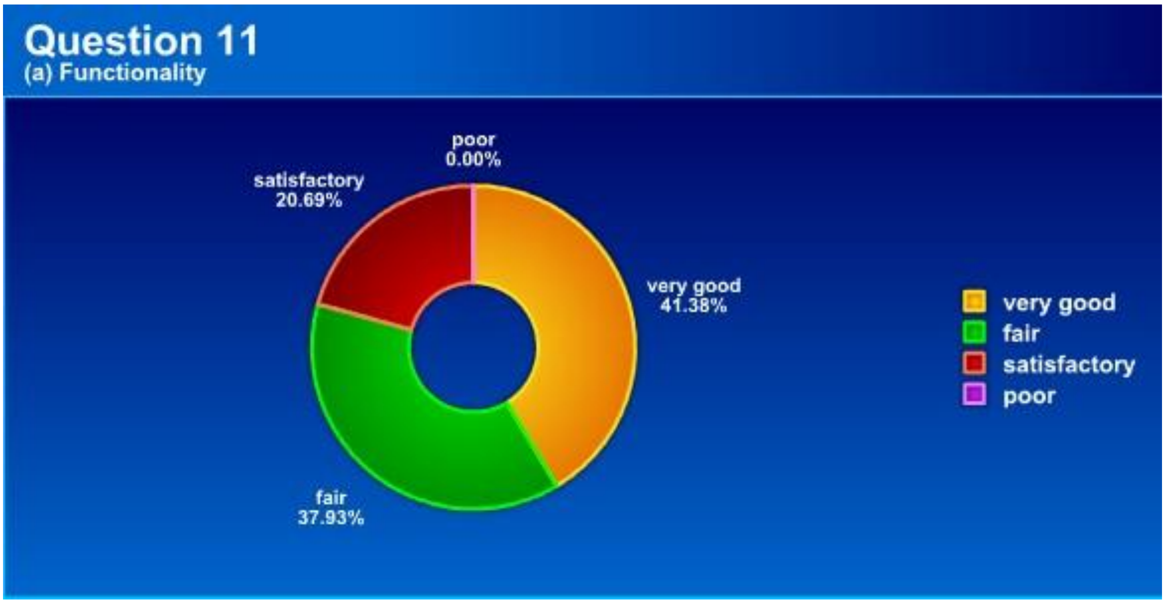


Figure 7.11a Functionality Rating.

The chart indicates that 41.38% of 29 respondents considered that the functionality their e-learning space was very good; 37.93% thought it was fair while 20.69% said it was satisfactory.

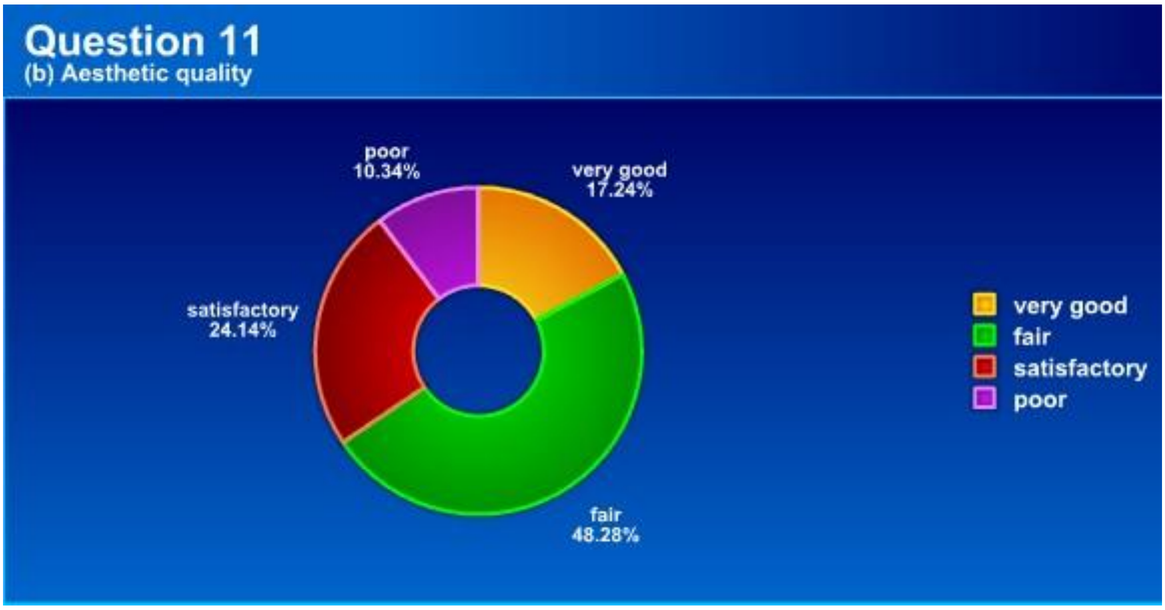


Figure 7.11b Aesthetic Quality Rating

The results indicates that 48.28% of the 29 respondents considered that the aesthetic quality of their e-learning space was fair, 24.14% indicated that it was satisfactory, 17.24% indicated that it was very good and 10.34% thought that it was poor.

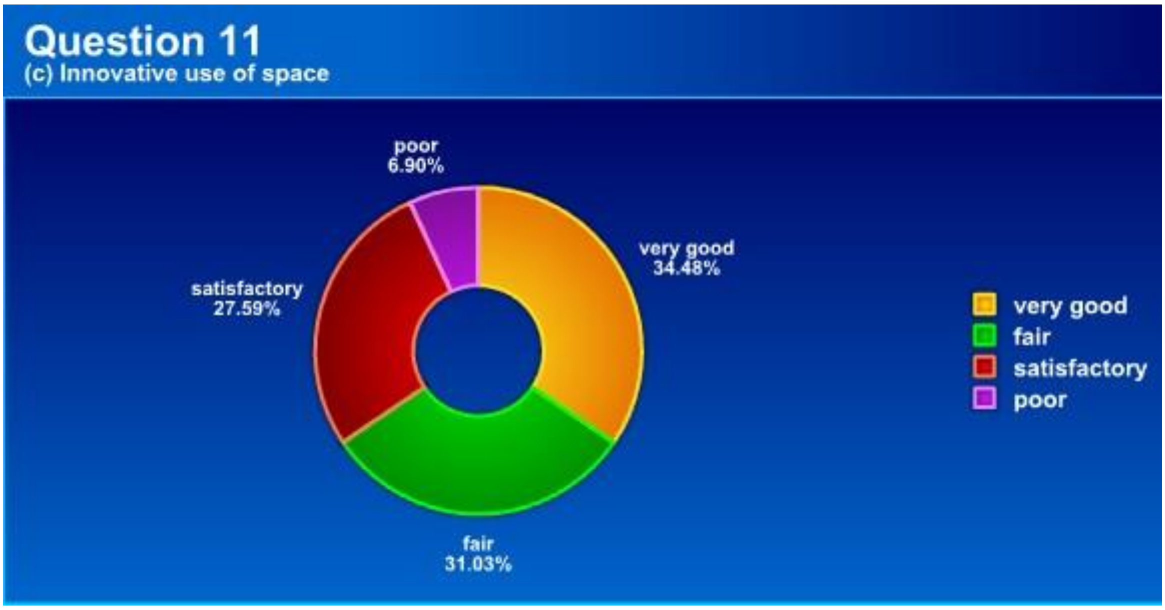


Figure 7.11c. Innovative Use of Space.

The results obtained indicate that 34.48% of the 29 respondents considered the innovative use of space to be very good, 31.03% indicated that it was fair and 27.59% satisfactory. However, 6.90% indicated that it was poor.

Q12 Which of these space design solutions effectively supports your teaching and learning requirement within your school? (Please select all that apply)

The results obtained indicates that a greater number 31.3% (21 people) of 29 respondents selected option 'E- Spaces fitted with good lightening, ventilation and acoustics to absorb sound during collaborative learning'. The nearest figures to this were 23. 9% (16 people) of the 29 respondents who selected option 'C -Flexible furniture arrangement to allow for multipurpose use'; followed closely by 22.4% (15 people) who selected option 'B- Enclosed space plans (walls and glass partitioned areas)' as shown in figure 7.12. 7.5% (5 people) selected options D and F respectively; enclosed spaces with opaque walls, and use of fixed furniture for formal teaching and learning.

These results therefore flagged up the notion that some basic considerations of architectural design within learning spaces such as **ventilation, lighting, acoustics, flexible furniture arrangement, multipurpose use of space and space planning** helped to define the users' perception of a well-designed e-learning space. Figure 7.12 is a graphic representation of the data.

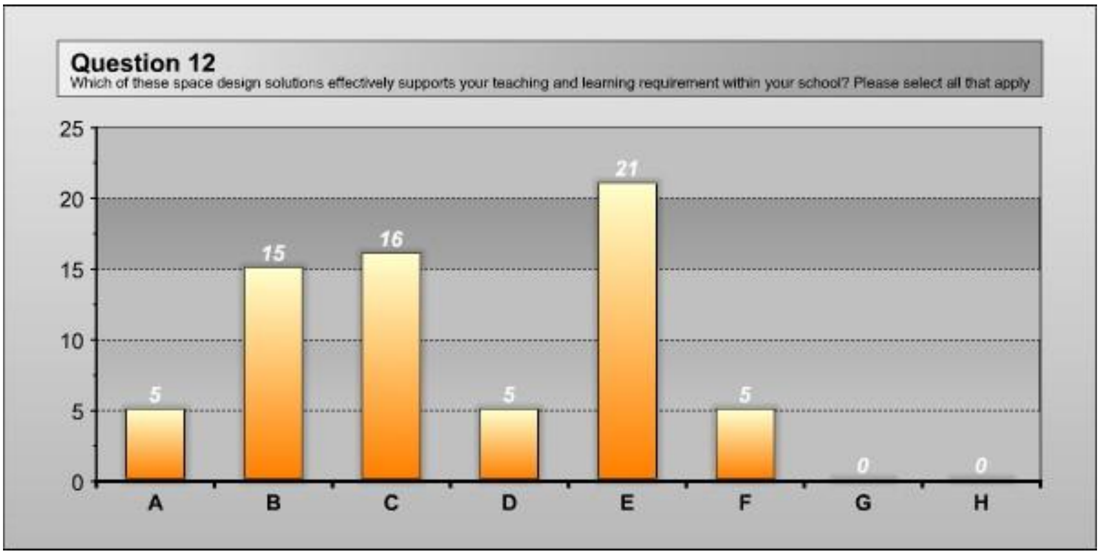


Figure 7.12 Space Design Solutions that were Effective For Supporting Users Teaching And Learning Requirements

Questions on the Impact of Space Design on Teaching and Learning (Q13- Q14).

Q13 Do you think that the space design of the teaching and learning environment has improved your teaching and learning experience please tick where (1) is strongly agree and (4) is strongly disagree. As shown in figure 7.13

The results obtained showed that 55.17 % (16 people) of the 29 respondents agree i.e. they selected ‘2’ agree while 31.03 % (9 people) indicated that they strongly agree ‘1’. Therefore majority of respondents, a total of 25 people agree that the teaching and learning environment has improved their learning experience. However a small number, 13.79% (4 people) indicated that they disagree. Figure 7.13 is a graphic representation of the data.

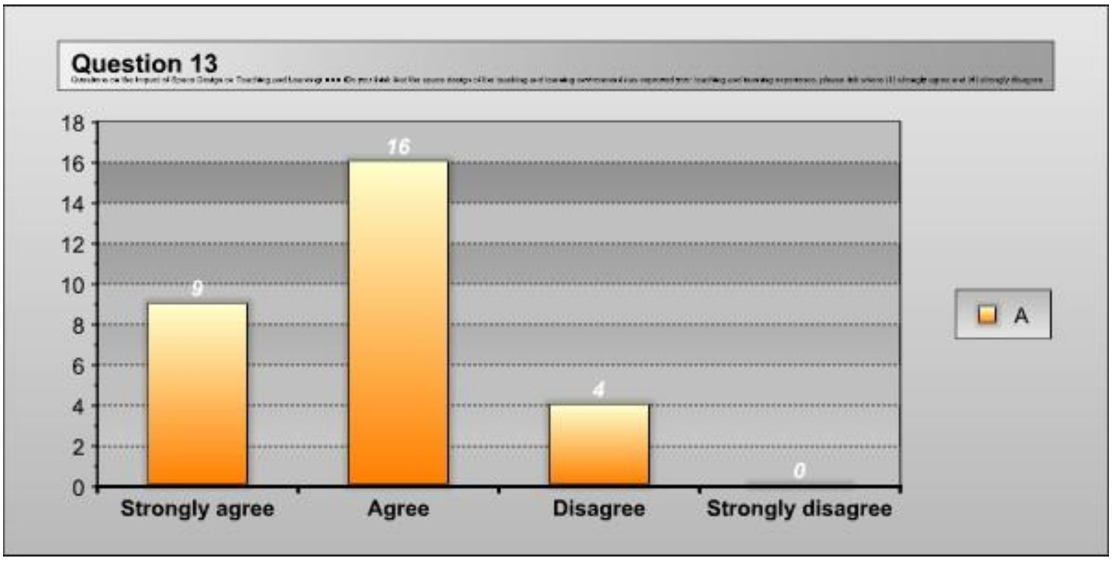


Figure 7.13 Chart of How Space Design Has Improved Users' Teaching and Learning Experience

The next question aimed to look at the architectural design elements of the teaching and learning space that could enhance or impair the users' overall learning or teaching experience. As such some design elements which were considered to be important to the effective delivery of space design were investigated. These were- acoustics, ventilation, lighting, circulation and accessibility, the space layout, furniture design and flexibility, as well as location of facilities and services within the e-learning spaces.

Q 14) What aspects in your opinion have enabled your teaching and learning experience when using the institution's facilities for your study or work? Please grade in order of preference where (1) is the lowest and (5) is the highest (it is assumed that the choice of 3, 4 or 5 can arguable be considered a medium to high preference)

The results are further simplified in the charts hereunder from Fig 7.14a-h. From the results, it can be seen that:-

- A medium preference rating of '3'was selected by 41.38% (12 people) for the design and location of the stairs and lift while the lowest rating of '1' was selected by 24.14% (7 people) and a low rating of '2' was also selected by 17.24% (5 people) for the same item therefore a total of 17 people indicated a medium to high rating which exceeded the low rating indicated by 12 people as indicated in fig 7.14a.

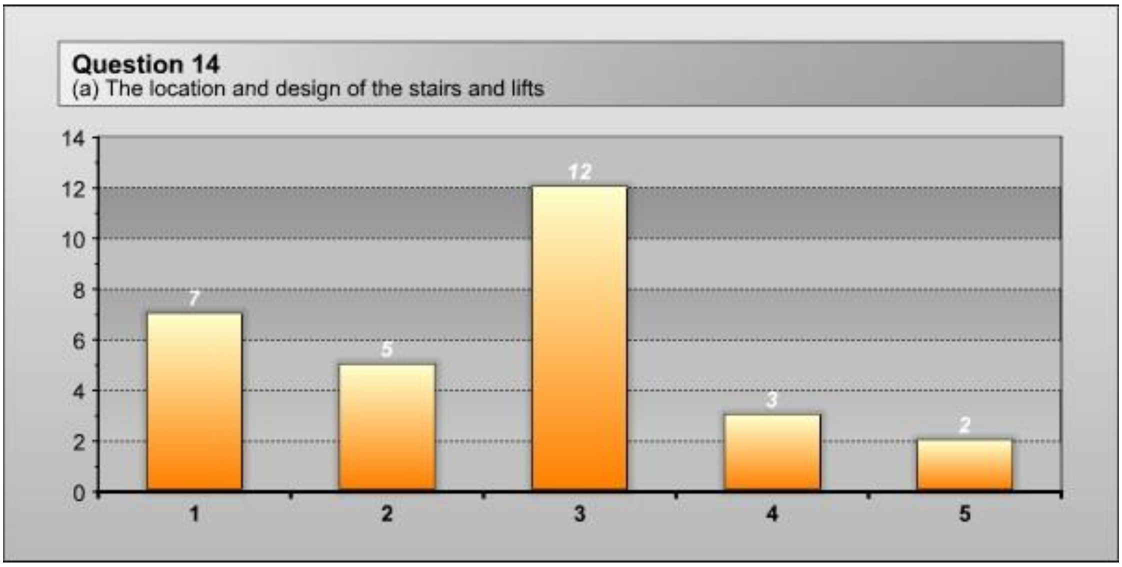


Figure. 7.14a. Location of Stairs and Lifts

- For the acoustics-sound levels, a medium preference rating of '3' was selected by 44.83% (13 people) while an additional high rating of '4' was selected by 17.24% (5people) and the highest rating of '5' by 17.245(5people) which brings the medium to highest rating to a total of 23 out of 29 people as shown in figure 7.14b.

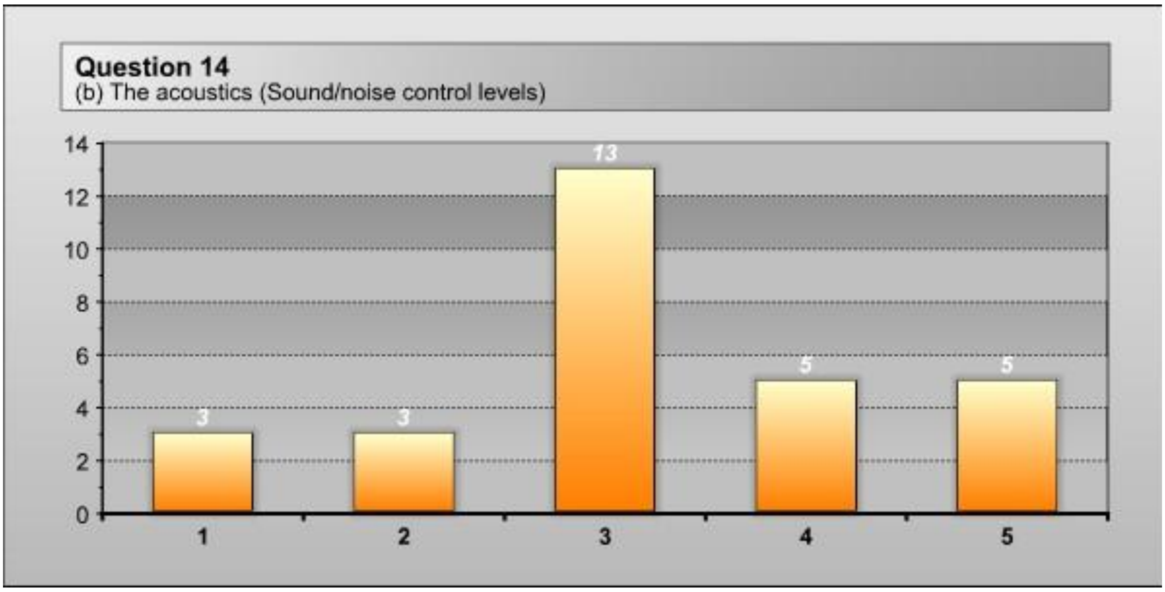


Figure. 7.14b. Acoustic Level Rating

- For the furniture type and arrangement 44.83% (13 people) of the 29 respondents indicated a medium preference rating of '3', while an additional 27.59%(8 people) indicated a high rating of '4' and 17.24% (5 people) indicated their highest preference rating of '5. Therefore a medium to highest rating was selected by a total of 26 out of 29 people as shown in figure 7.14c.

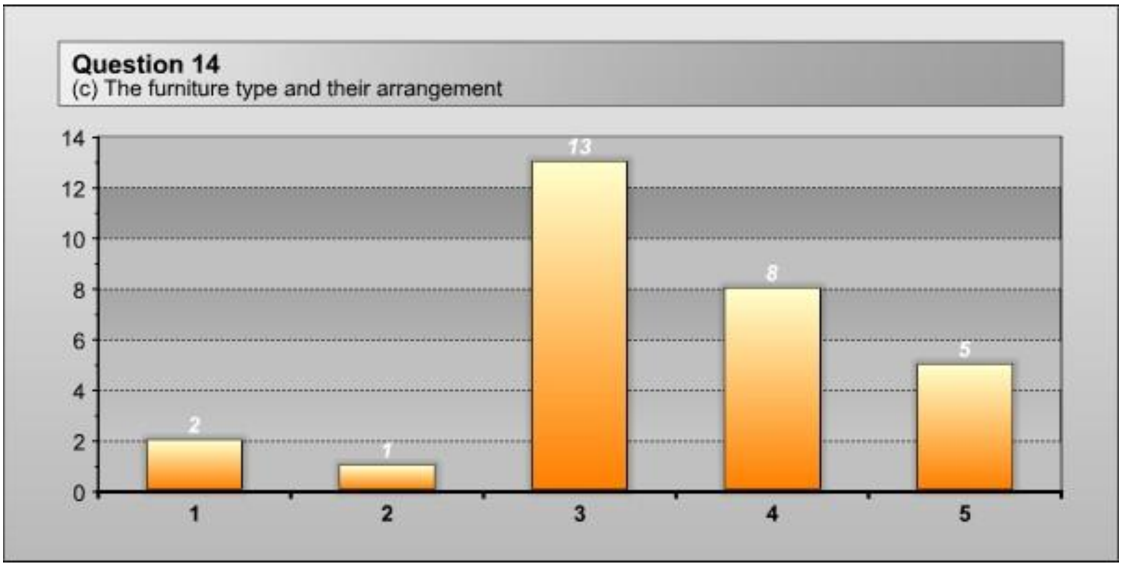


Figure 7.14c Furniture Type And Arrangement

- For the Space design and layout, 27.59% (8 people) of the 29 respondents selected a medium rating of ‘3’, while an additional 24.14% (7 people) selected a high rating of ‘4’and also an additional 24.14% (7 people) selected the highest rating of ‘4’ as shown in figure 7.14d.

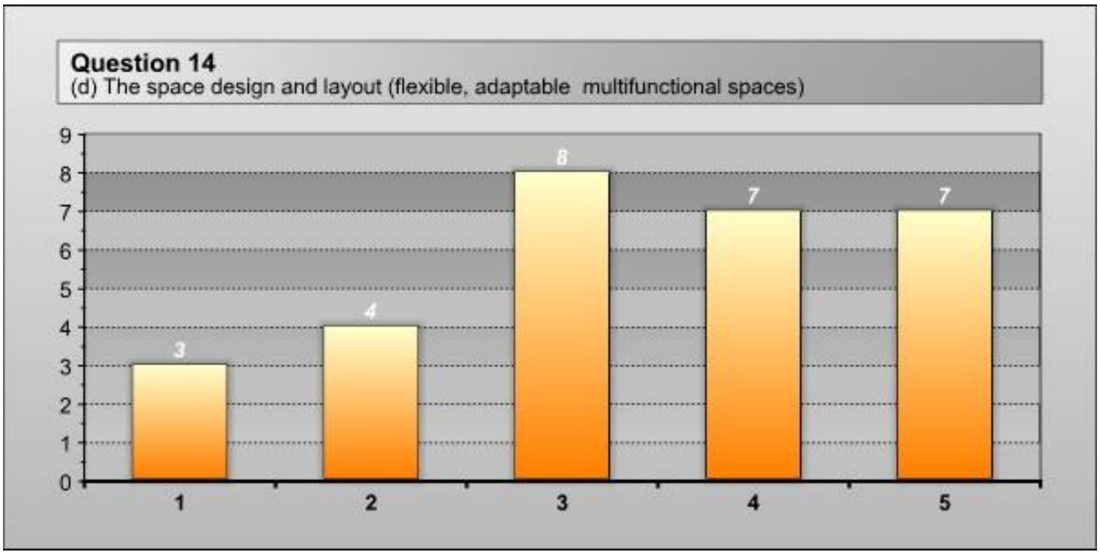


Figure 7.14d Space Design and Layout

The results in figure 7.14d indicated that a total of 22 out of 29 people selected medium to highest rating for this item.

- For the location of all fittings and services 44.83% (13 people) of the 29 respondents indicated their preference rating of '3' while an additional 17.24% (5people) indicated a high preference rating of '4 and 5' respectively. A total of 23 out of 29 people gave medium to highest rating as shown in figure 7.14e.

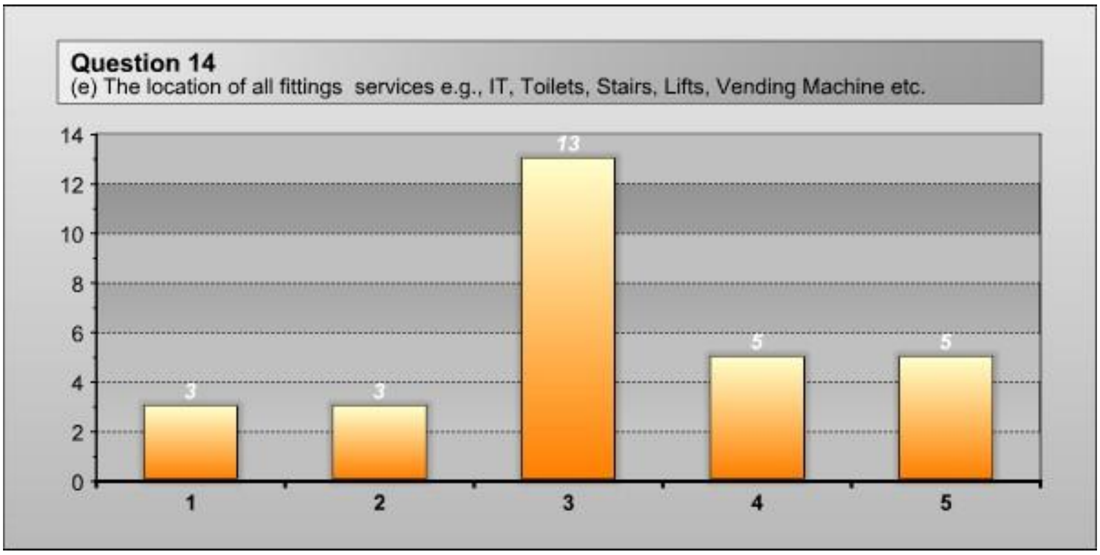


Figure. 7.14e. Location of All Fittings

- For the circulation design, 31.03% (9 people) indicated a preference rating of '4' while an additional 27.59% (8 people) indicated the highest preference rating of '5' and 20.69% (6people) selected the medium rating of '3'for the same item. A total of 23 out of 29 people selected the medium to highest rating as shown in figure 7.14f.

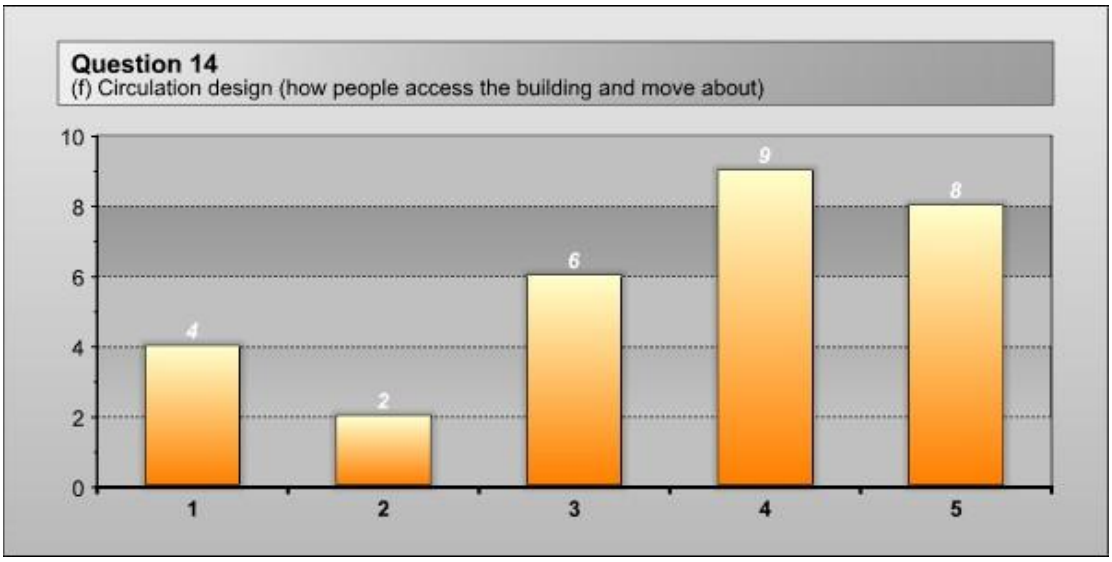


Figure. 7.14f Circulation Design

-For the ventilation design, 44.83% (13 people) indicated a medium preference rating of '3' while an additional 31.03%(9 people) indicated a high rating of '4' the total of 24 out of 29 people selected the medium to highest rating as shown in Fig 7.14g.

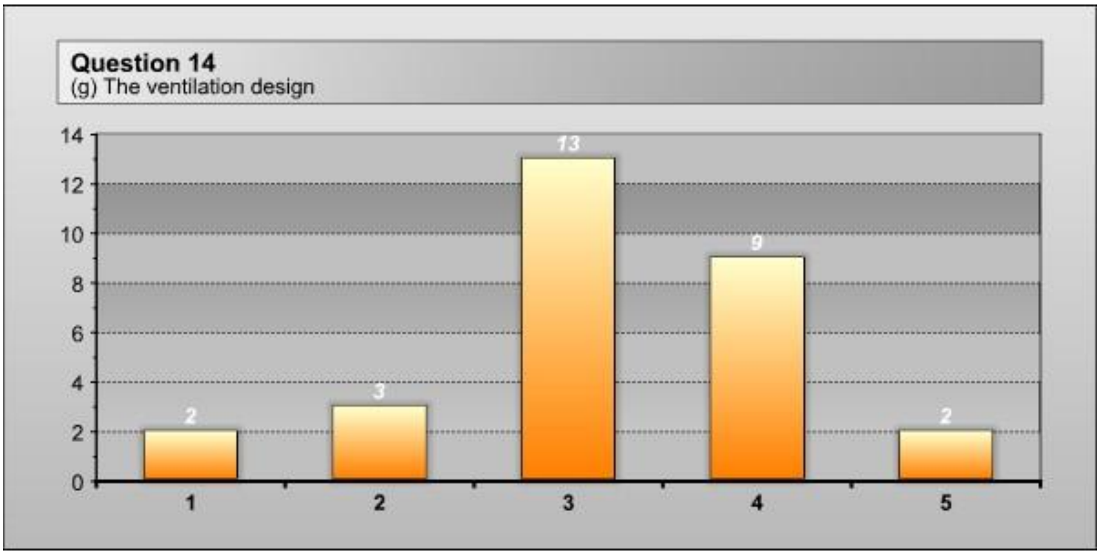


Figure 7.14g. Ventilation Design

-For the lighting levels, 34.48% (10 people) selected a high preference rating of '4' while an additional 27.59% (8 people) indicated a medium preference rating of '3' and 24.14% (7 people) selected the highest rating of '5' for the same item, bringing the medium to highest rating to a total of 25 out of 29 people as shown in figure 7.14h.

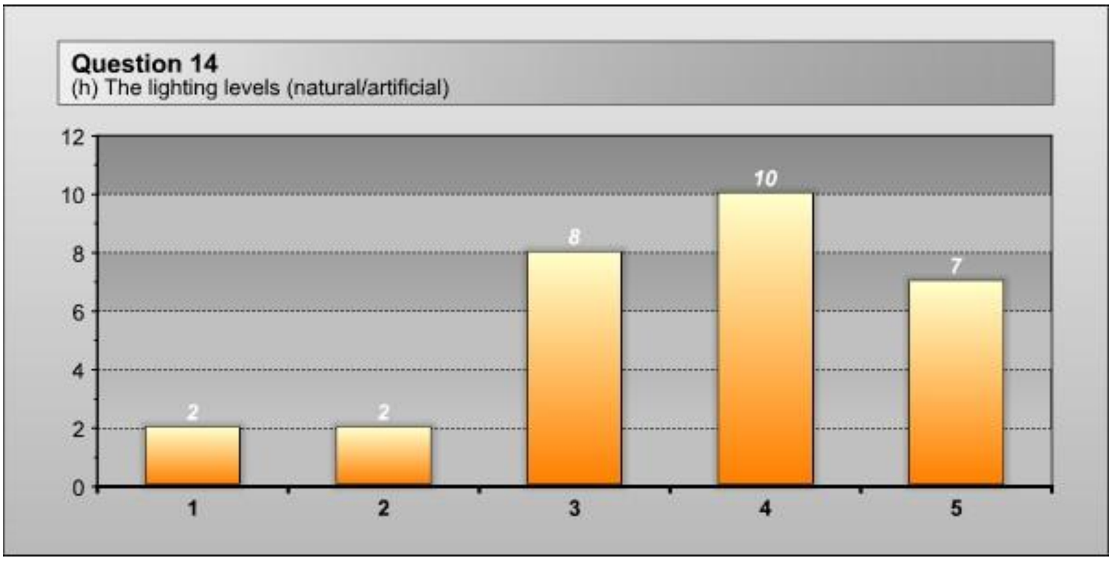


Figure. 7.14h. Response for Lightening Levels

In order to have a further understanding of the users' perception of the suitability of the e-learning space design in their HEI, the next question about the level of perceived suitability was asked.

Q15) Do you feel that the space design of the teaching and learning environment is suitable for your requirements?
Please tick where (1) is very suitable and (4) is very unsuitable

The results showed that 44.83% (13 people) felt that it was fairly suitable while an additional 41.38%(12 people) felt it was very suitable bringing the number of respondents who perceived that their environment was suitable for their requirements to a total of 25 out of 29 people which is the majority compared to the 13.79% (4 people) who felt otherwise as shown in the figure 7.15.

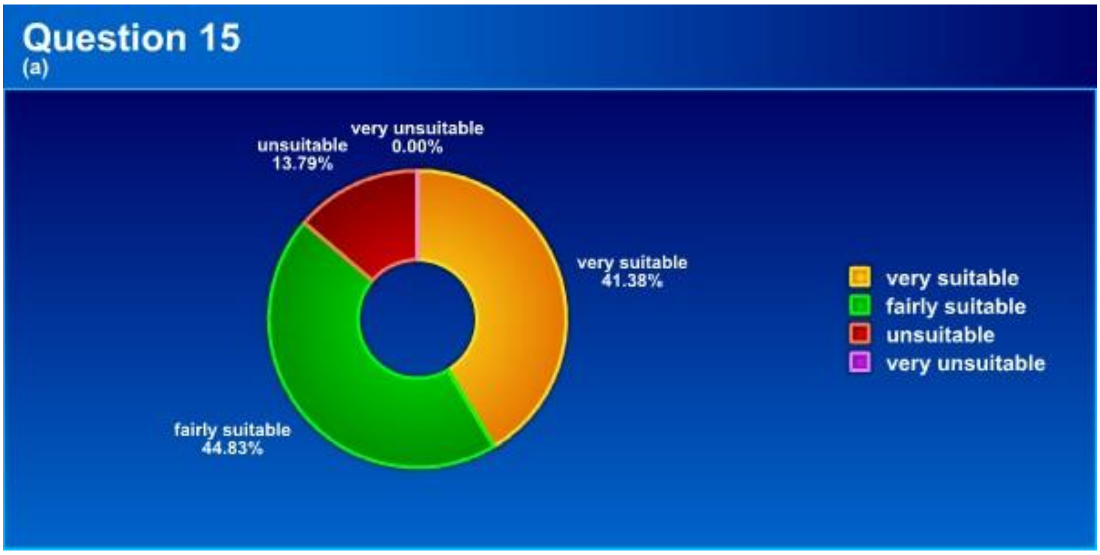


Figure. 7.15. Suitability of Users' Teaching And Learning Environment

The next question aimed to examine the effective incorporation of elements of inclusive design considerations in the design of e-learning spaces or the lack of it.

Q16) Some inclusive design considerations within the space design of the teaching and learning environment are listed below. Please grade them according to their effectiveness within your institution where (1) is the lowest and (5) the highest

The results obtained for this question are further displayed as separate charts to enable better understanding as shown in figure 7.16a-i.

The results indicated that 44.88% (13 people) selected a rating of ‘3’ for the effectiveness of the provision of wide corridors and doors for wheel chair users in their HEI. An additional 24.14% (7 people) selected a rating of ‘4’ while 27.58% (8 people) selected a rating of ‘5’ which brings the total of positive responses to 28 out of 29 respondents. Figure 7.16a illustrates this data.

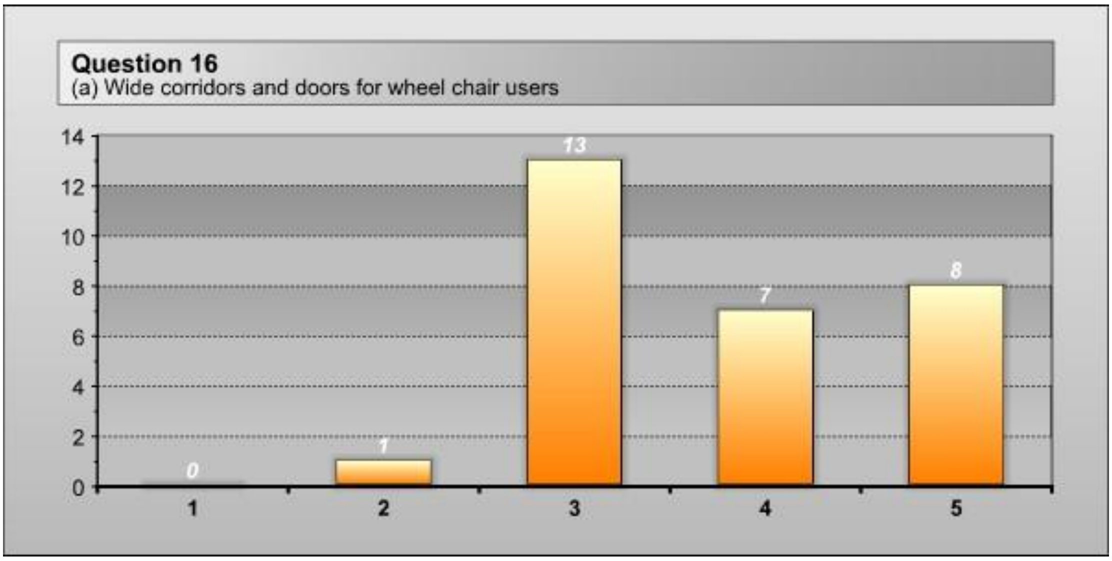


Figure 7.16a. Effectiveness of The Provision of Wide Corridors As An Aspect of Inclusive Design

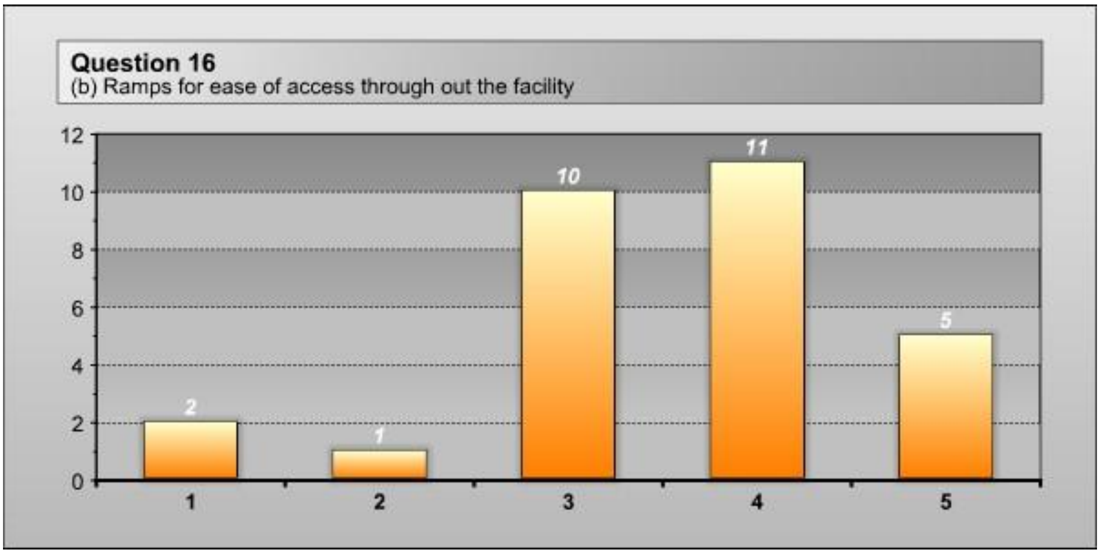


Figure 7.16b. Effectiveness of The Provision of Ramps for Ease of Access As An Aspect of Inclusive Design

For the effectiveness of 'ramps for ease of access throughout the facility' 37.93% (11 people) selected a rating of '4' which is a positive response. An additional 34.48% (10 people) selected a positive rating of '3' as well as 17.24% (5 people) who selected a '5' which is the highest rating. Therefore the positive rating of responses was a majority (26 out of 29 respondents) as illustrated in figure 7.16b.

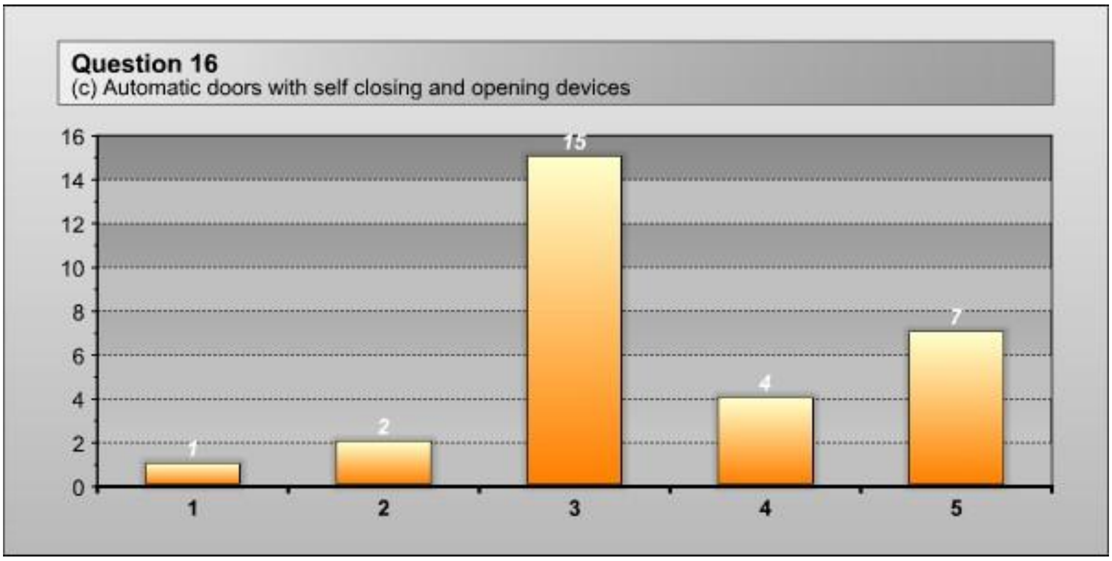


Figure. 7.16c. Effectiveness of The Provision of Automatic Doors As An Aspect of Inclusive Design

For the effectiveness of automatic doors with self-closing and opening devices, 51.72% (15 people) gave a positive rating of '3' and an additional 24.14% (7 people) selected a positive rating of '5' as well as 13.79% (4 people) who selected a rating of '4'. Therefore the majority of respondents (26 out of 29 respondents) gave a positive rating as shown in Figure 7.16c

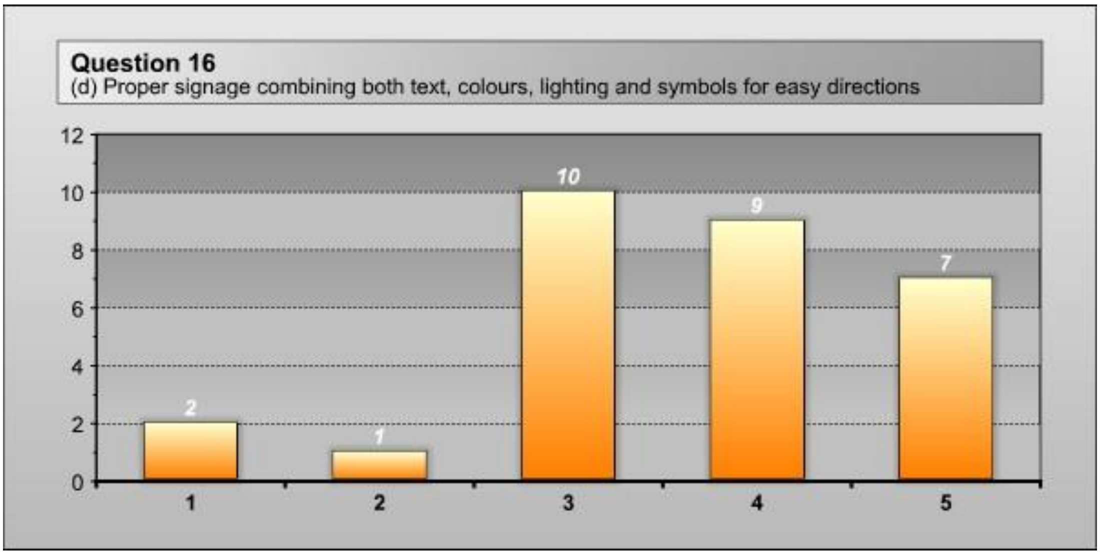


Figure 7.16d Effectiveness of the Provision of Adequate Signage As an Aspect of Inclusive Design

For the provision of proper signage combining both text, colours, lighting and symbols for easy direction, 34.48%(10 people) selected a rating of '3' while an additional 31.03%99 people) selected a rating of '4' as well as 24.14% (7 people) who selected a highest rating of '5'. Therefore a total of 26 Respondents out of 29 gave a positive rating (between 3-5) for this item while 3 respondents gave low ratings as illustrated in figure 7.16d.

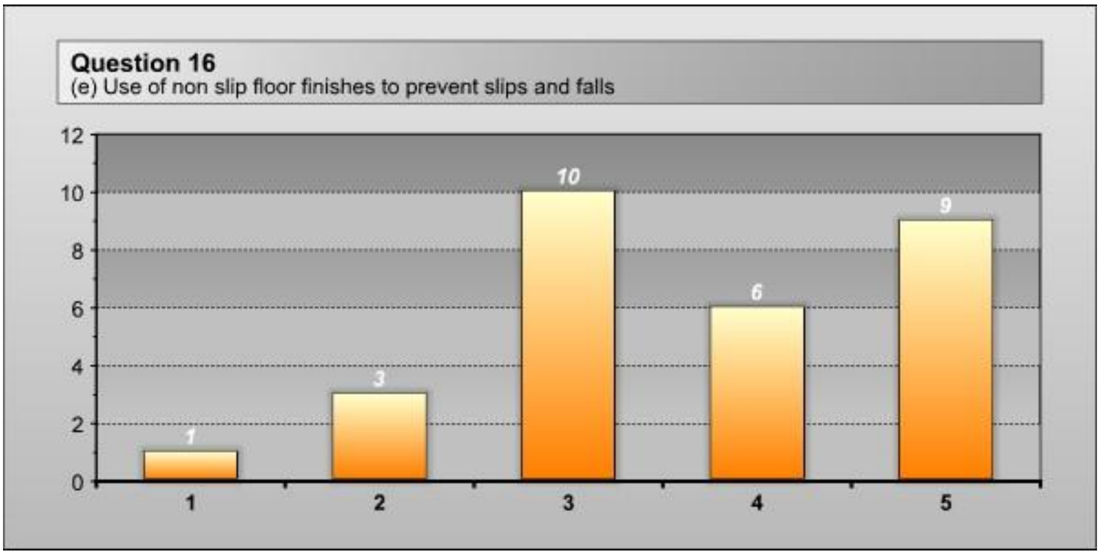


Fig. 7.16e Effectiveness of Non Slip Flooring As An Aspect Of Inclusive Design

For the use of non-slip floor finishes to prevent slips and falls, 34.48% (10 people) selected a rating of '3' while an additional 31.03%(9 people) gave a highest rating of '5' as well as 20.69% (6 people) who as well gave a positive rating of '4'. Therefore a majority of 26 respondents gave a positive rating between (3-5) for this item while a minority of 3 respondents gave low ratings (between 1-2) as shown in figure 7.16e.

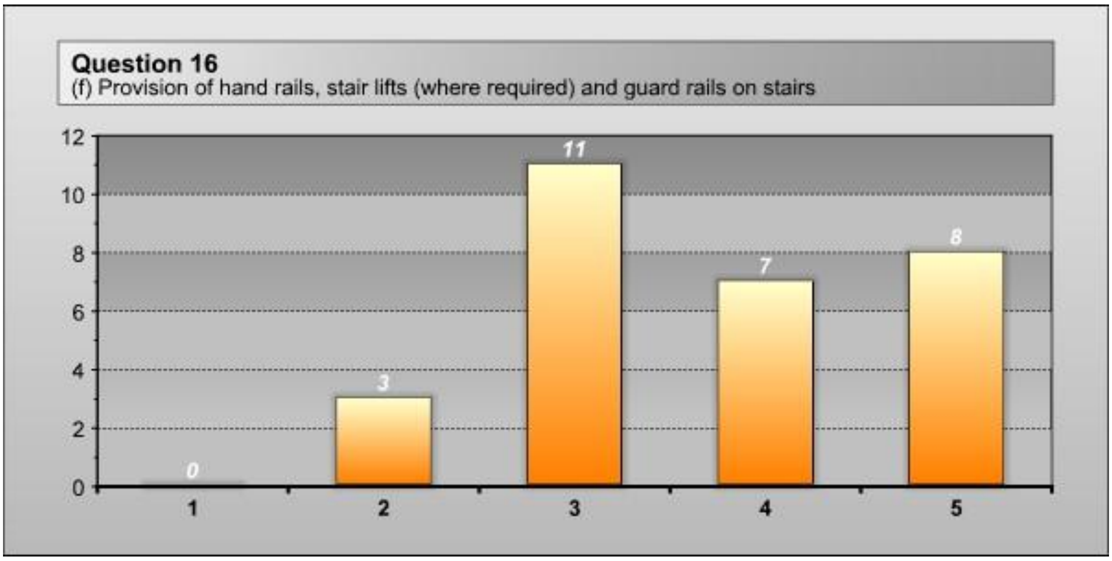


Figure 7.16f. The Provision of Handrails, Stair Lifts And Guard Rails

Figure 7.16f shows results obtained for the provision of handrails, stair lifts (where required) and guard rails on stairs. 37.93% (11 respondents) gave a high rating of '3' in addition to this, 27.59% (8 respondents) gave a highest rating of '5' along with 24.14% (7 respondents) who selected a high rating of '4' as well. The majority of respondents, i.e. a total of 26 out of 29 gave a medium to high rating (between 3-5) compared to the minority of 3 respondents who selected a low rating.

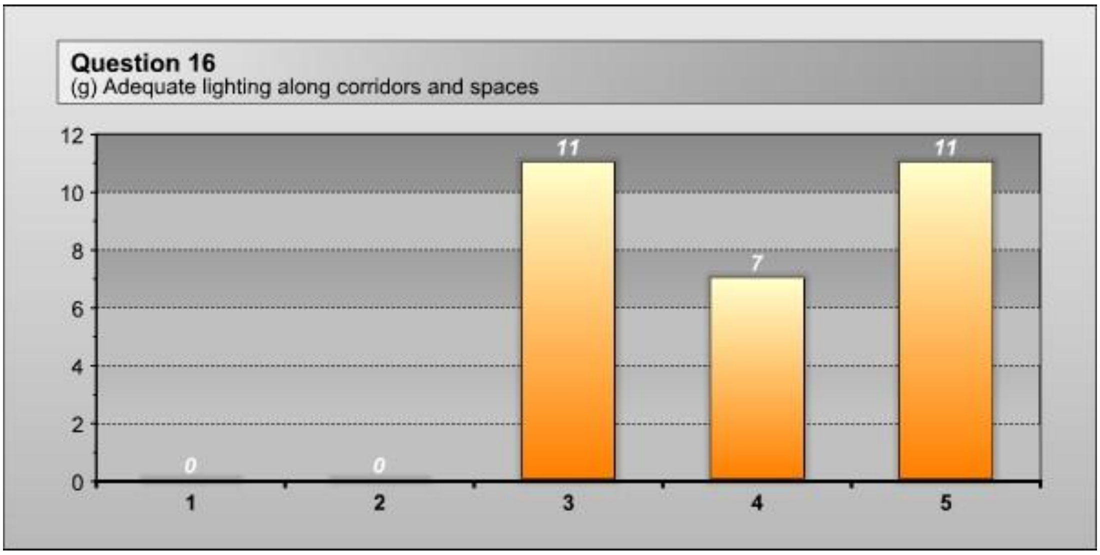


Figure 7.16f Chart of Response to the Effectiveness of the Provision of Adequate Lightening Along Corridors As an Aspect of Inclusive Design

Figure 7.16g is a representation of the results obtained for the provision of adequate lighting along corridors and spaces. 37.93% (11 respondents) gave a medium rating of

‘3’ as well as 37.93% (11 respondents) who also a highest rating of ‘5’. In addition to this, 24.14% (7 respondents) also gave a high rating of ‘4’. The majority of respondents gave a medium to high rating of 3-5; no respondent gave a low rating.

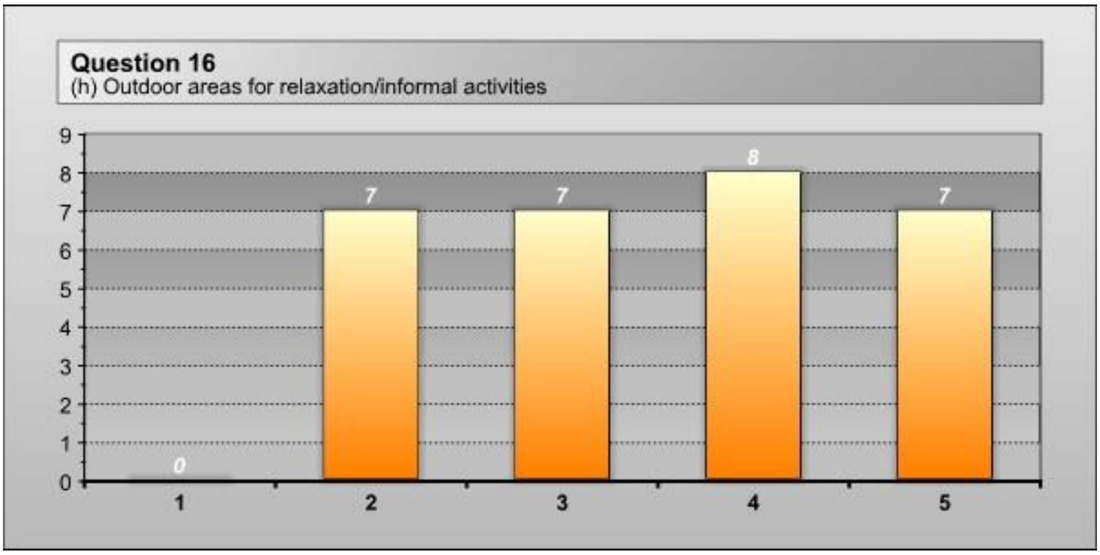


Figure 7.16h. Effectiveness of the Provision of Wide Corridors As an Aspect of Inclusive Design

Figure 7.16h is a representation of the results obtained for provision of ‘outdoor areas for relaxation/informal activities’. The results indicates that 27.59% (8 respondents) selected a high rating of ‘4’ while an additional 24.14% (7 respondents) selected a medium and highest rating of ‘3’ and ‘5’ respectively. 24.14% (7 respondents) selected a low rating of ‘2’ as well, therefore, a majority of 22 respondents out of 29 gave medium to highest ratings (3-5) while a minority of 7 out of 29 gave a low rating of ‘2’.

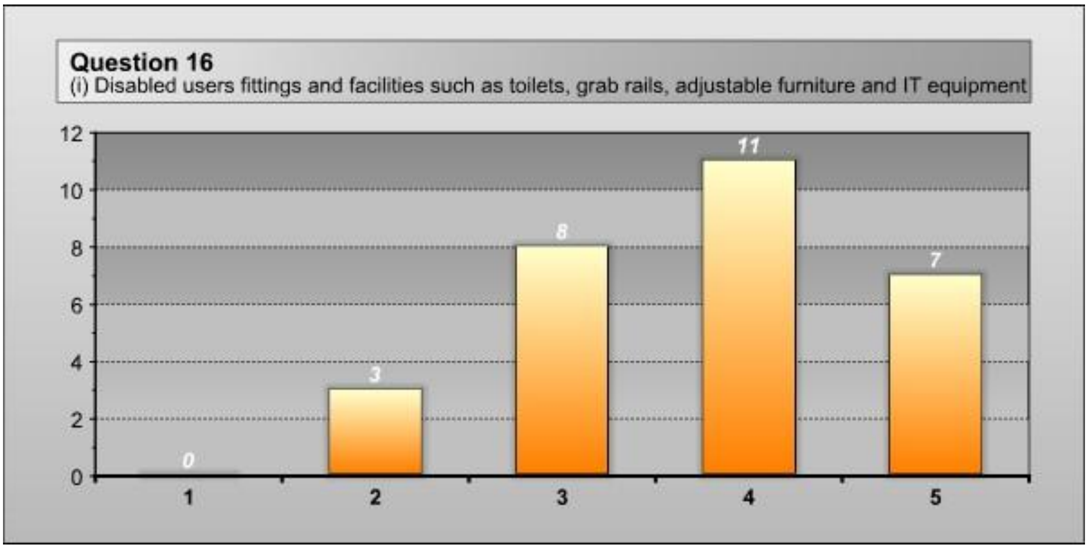


Figure 7.16i. Effectiveness of the Provision of Disabled Users Facilities As an Aspect of Inclusive Design

Figure 7.16i illustrates the results obtained for the provision of 'disabled users' fittings and facilities such as toilets, grab rails, adjustable furniture, and IT equipment.' 37.93% (11 respondents) gave a high rating of'4' and an additional 27.59% (8 respondents) gave a medium rating of '3'. However, 24.14% (7 respondents) gave a highest rating of '5', therefore the majority of respondents i.e. 26 out of 29 gave a medium to highest rating, while a minority of 10.34% (3respondents) had indicated a low rating of '2'

The next question aimed to obtain information about users involvement /participation in the space design projects

Q17) As a user, was your opinion sought about the design of the teaching and learning environment provided either during the design process or during the construction stage?

The response obtained as tabulated above indicated that majority of the respondents' i.e. 86.2% (25 people) had not been involved in the design process or construction stage. However, 13.8% indicated that they had been involved. Figure 7.17 illustrates this graphically.

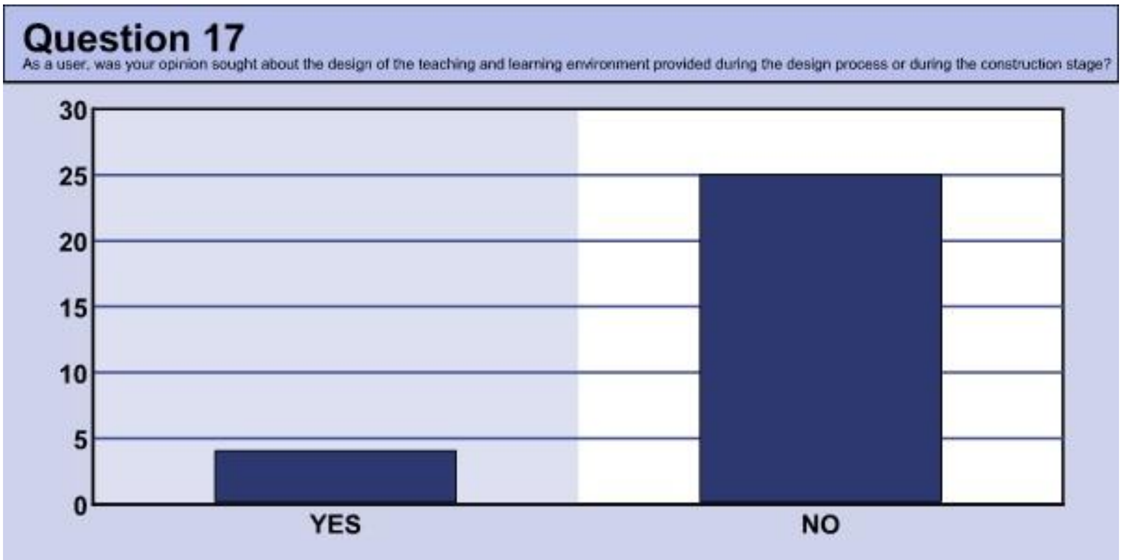


Figure 7.17. Users Involvement In Space Design

The following question aimed to investigate the users' perception of the technological efficiency of their teaching and learning environment

Q18) The space design of the teaching and learning environment is technologically efficient because? (Please select all that apply).

From the results obtained, majority of the respondents 32.4% (15 people) felt that the space was technologically efficient because ‘the teaching and learning spaces were adapted into a technology supported teaching and learning environment’, 19.6 % (10 people) of respondents felt that the efficiency of the technology within the spaces were due to ‘the spaces being upgraded with recent cutting edge technology features. also 19.6 %(10 people) indicated that the efficiency was based on the spaces being initially designed as a technology focused environment’. Some 15.7% (8 people) indicated that the efficiency was due to fact that ‘the technology and equipment determined the space design of the teaching and learning environment’ while a few of the respondents (11.8% - 6people) indicated that the efficiency was because ‘the users determine the space design and type of technology used within the teaching and learning environment’.

Some other response were as follows ‘it is not technologically efficient’, (no reason for this opinion was given by the respondent); Another respondent’s comment was ‘joined the university after the design’.

This data is represented graphically in figure 7.18.

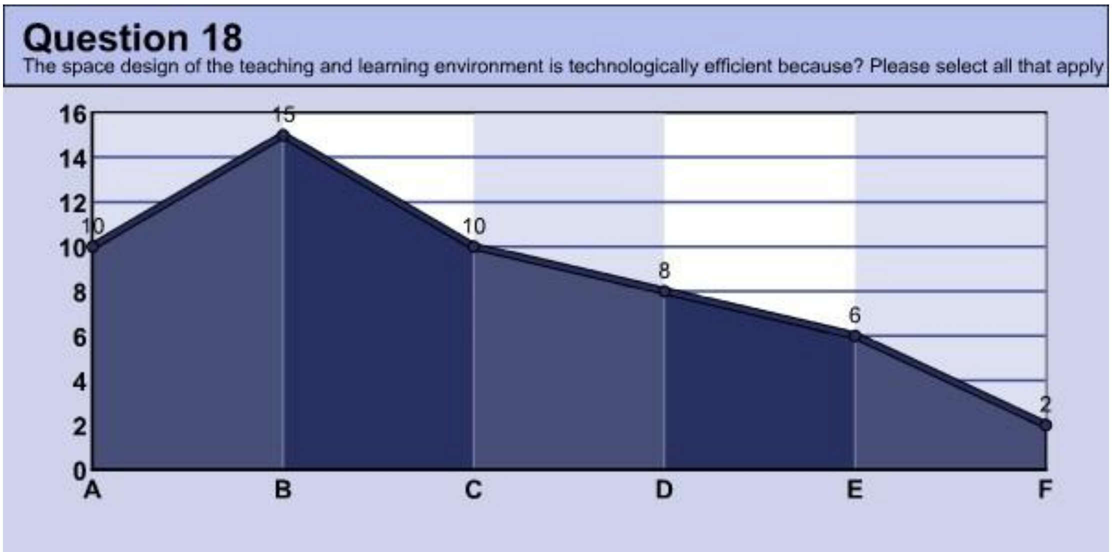


Figure 7.18. Efficiency of the Space Design With Respect to the Provision of Technology.

The next question aimed to find out how many of the respondents were happy to participate in further interview so as to enable the gathering of more qualitative data.

Q19) Would you be interested in participating in a further interview?

The response obtained showed that only 37% (11 people) of the 29 respondents were willing to participate in further interview. Figure 7.19 is a pie chart of the response.

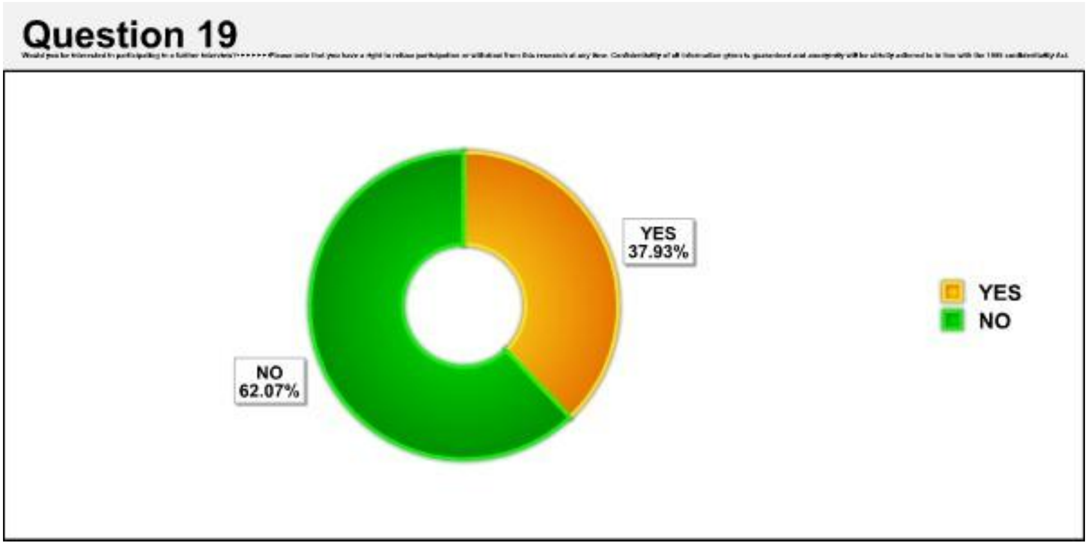


Figure 7.19. Respondents' Willingness to Participate in Further Interview.

7.5 REVIEW OF THE RESEARCH QUESTIONS AND HYPOTHESIS

The responses obtained from the users' survey have to some extent answered some of the research questions:

- With respect to questions I) how has technology advancement affected the design or provision of e-learning environments and facilities in HEIs? The response in question 10 Users' survey showed that majority of them were aware of the impact of technology on the space design of their teaching and learning environment State briefly what or how it has been answered
- And research question VI) How can inclusive design be incorporated in future e-learning spaces. The response showed that the users were aware of the level of inclusive design considerations that had been provided within their learning environment as shown by the responses on the ratings they gave to the different features in question 16 above.' Majority of users' expect that by providing 'A space that has been fitted with technology supported learning facilities with inclusive design consideration for ease of accessibility and usage by all' this issue can be resolved as indicated in response to question 10.

The results from the interviews conducted and the case studies were able to deal with the other research questions in detail and are presented in the subsequent chapters.

7.5.1 Review of Findings in Respect to Hypothesis

The findings from the case study report, forums and pilot studies suggests that hypothesis **No 1- A user's learning experience can be improved by the provision of a good e-learning environment i.e. the assumption is that good design of technology supported learning spaces has an impact on the users' learning outcomes**; was proved to be true as was indicated by the responses to question Q 14 about what aspects had enabled teaching and learning experiences when using the institution's facilities for studying or work? (it is assumed that the choice of 3, 4 or 5 can be considered a medium to high preference)

7.6 CHAPTER SEVEN SUMMARY

This Chapter presented an understanding and background thinking to the beginning of the analysis and presentation of research findings obtained from the Forums and pilot studies which served as precursors to the actual data gathering method of the surveys. The results from the Users' questionnaire survey was presented and briefly analysed.

The findings from the forums dealt with the various aspects of the research focus identified while the survey results showed that hypothesis No 1 was true

The other two sets of surveys administered i.e. Questionnaire results from the Designers/Architects and Questionnaire results from the Executives are presented, discussed and analysed in the chapter 9.

CHAPTER EIGHT-CASE STUDY OUTCOME

Section Two- focuses on the research methodology developed which then led up to the field work done. It presents the data from some survey outcomes and case studies conducted. It comprises of chapters six to **eight.**

8.0 INTRODUCTION

This chapter focuses on the outcome of the selected case study/site based analysis of the HEIs. The interpretation and presentation of the data was based on the recommendation of Yin, (2009) for case study collation and analysis. How each case study dealt with the different aspects of the research focus and how the findings support Hypothesis No 2 is discussed. This process enabled the researcher apply the case study and interview tools for data gathering, testing, measurement and comparing results in order to eliminate any bias. The methodology adopted to achieve those goals and objectives are also examined. The precise techniques used are supported by the literature that was reviewed earlier in the study. These methodologies were mainly based on the recommendation of Yin, (1994, 2009) comprising of the following four steps:

I. Design the case study,

II. Conduct the case study,

III. Analyse the case study evidence, and

IV. Develop the conclusions, recommendations and implications.

The discussion in this chapter starts with a general introduction of some of the background information obtained (case study guidelines) in order to inform the reader. After which, the above steps of the methodology are explored in detail. Thereafter, a summary that brings all these information together in a concise manner is presented.

8.1 DESIGN THE CASE STUDY

From the field work explained, the schedule and plan used for conducting the case studies involved a one day site visit to the institutions. During which site based analysis of e-learning spaces in the selected HEIs were done. **This process enabled the researcher fulfil the requirements of Objective II which was 'to identify best practice designs good examples',** also an understanding of the unique individual project strategy used for the delivery of such spaces was obtained by using the case study guidelines. Furthermore, interviews with the users of such spaces were conducted in order to obtain information on various user patterns previously identified during the literature review stage as well as the design requirement preferred by the users. This exercise was the major aspect that produced the qualitative outcomes of the research which were used to verify some of the data that were previously collated after the three part Forums.

If we recall, the case study criteria developed in chapter six were:

- Criteria One: - Type of space identified within HEI Campuses
- Criteria Two: - Technology use and adaptation within the design of e-learning spaces
- Criteria Three: - E-learning space design research focus

Also the type of questions used in the interviews which helped with the design of the case study were listed in section 6.9.3.1 of chapter six.
These have been reported within the context of each case study conducted.

8.2 CONDUCT THE CASE STUDY

This is the second stage of the methodology (Yin 1994, 2009) used in this study. The tasks here involved: *Preparation for Data Collection*, *Distribution of the Questionnaire*, and *Conducting Interviews*. The application and outcome of the first and third tasks have been presented together in the following section; since they are interrelated (while the previous chapter presented the data from the questionnaire survey).

Table 8.1 shows six primary sources of evidence for case study research (Yin 1994, 2009). All the sources of evidence were used in this study except 'Physical Artefacts' as it was not required. All data collected were treated as a design issue that will enhance the construct and internal validity of the study, as well as the external validity and reliability (1994, 2009). Furthermore, the principles of data collection suggested by Yin were used namely:

1. Use multiple sources of data
2. Create a case study database
3. Maintain a chain of evidence

Table 8.1 Case Study Types of Evidence

Source of Evidence	Strengths	Weaknesses
Documentation	• stable - repeated review • unobtrusive - exist prior to case study • Exact - names etc. • broad coverage - extended time span	• irretrievability - difficult • biased selectivity • reporting bias - reflects author bias • access - may be blocked
Archival Records	• Same as above • precise and quantitative	• Same as above • privacy might inhibit access
Interviews	• targeted - focuses on case study topic • insightful - provides perceived causal inferences	• bias due to poor questions • response bias • incomplete recollection • reflexivity - interviewee expresses what interviewer wants to hear
Direct Observation	• reality - covers events in real time • contextual - covers event context	• time-consuming • selectivity - might miss facts • reflexivity - observer's presence might cause change • cost - observers need time
Participant Observation	• Same as above • insightful into interpersonal behaviour	• Same as above • bias due to investigator's actions
Physical Artefacts	• insightful into cultural features • insightful into technical operations	• selectivity • availability

Source: Yin, 1994, p. 80, 2009

Table 8.2 is a summary of the type of data source used for the case studies in this research based on the criteria listed above.

Table 8.2 Summary of Primary data sources collected for case study criteria

Case study data type	**Primary sources of evidence used**
Criteria One: - Type of space identified within HEI Campuses	documentation, archival records, interviews, direct observation, and participant observation
Criteria Two: - Technology use and adaptation within the design of e-learning spaces	documentation, archival records, interviews, direct observation, and participant observation
Criteria Three: - E-learning space design research focus	documentation, archival records, interviews, direct observation, and participant observation

8.3 ANALYSE THE CASE STUDY EVIDENCE

The information presented in this study were mainly descriptive and explanatory qualitative data obtained from documentation, observation, interview and site based analysis conducted during the investigations of case studies. The reports of five cases within one study are presented below. The outcome of this research stage presented hereunder involved looking at the research objectives and wider focus defined earlier and using these to interpret and analyse the huge data obtained so as to give some structure and organisation to enable the reader appreciate the findings. The five case studies reported hereunder where selected from the larger sample of fifteen case studies initially investigated. The reason for the selection and how the researcher arrived at the sample size were discussed in section 6.8 of chapter six.

8.3.1 Case Study I- University of Wolverhampton, UK

Date Visited – November 12 -2007**, Contact Person-** Ex-Pro- Vice Chancellor School of Information Tech, and senior staff**. Case Study Duration-** 2 weeks

This case study was selected because it dealt with the aspect of the research focus relating to '**the impact of blended learning on the design of spaces**' as well as the use of flexible furniture design as shown in figure 8.1a. Some of the good aspects identified during this study were as follows:-

- Multi- purpose spaces
- Different uses and activities
- Flexibility
- Adaptability
- Specialised spaces

- Social spaces, user led teaching

Figure 8.1a Teaching and Learning Spaces With Flexible Furniture Design.
Source: University of Wolverhampton Project Office, 2006

Introduction, background and context
The MI Building at the University of Wolverhampton was part of a series of reconstruction works executed by the University in an attempt to upgrade its learning environment and image. Other projects executed included the renovation of the old assembly hall/ MA laboratory, the new build MC building and other projects across the other Campuses of the Institution. The project also known as the "IT Complex" was regard as a 'unique landmark structure' which satisfied the several requirements of a HEI which, was in the process of unifying 'its academic prerequisite as it adopted and originated new concepts in teaching and technology supported learning space design through the regeneration agenda' (UoW, 2006)

The design brief was developed by the client and the architect. The structure joins a new building to the 'knuckle' of the sections of an existing building that had been within the courtyard of the City Campus. The School of Computing and IT, (SCIT) the School of Engineering and the Built Environment (SEBE) which have now been merged into the School of Technology (STECH) occupy the building, while the renovated space in the sections of the old building, provide contemporary specialist space with open access to IT for everyone in the institution.

Measurable outcomes- achievement of increased networking and communication amongst staff was made possible because of the shared office spaces the new building provided; designed around team 'pods' while users also explore the open plan specialist teaching and research area, enclosed with glass partitions. The open plan desk arrangements combined with the atria are a source of natural ventilation especially within areas of concentrated IT use. Feedback from users and site based observation showed that and the space has been in constant use since its completion and it is valued by the users'.

Figure 8.1b is a site plan showing the location of MI building within the courtyard of the city campus while figure 8.1c shows the structural drawing of the first floor plan view.

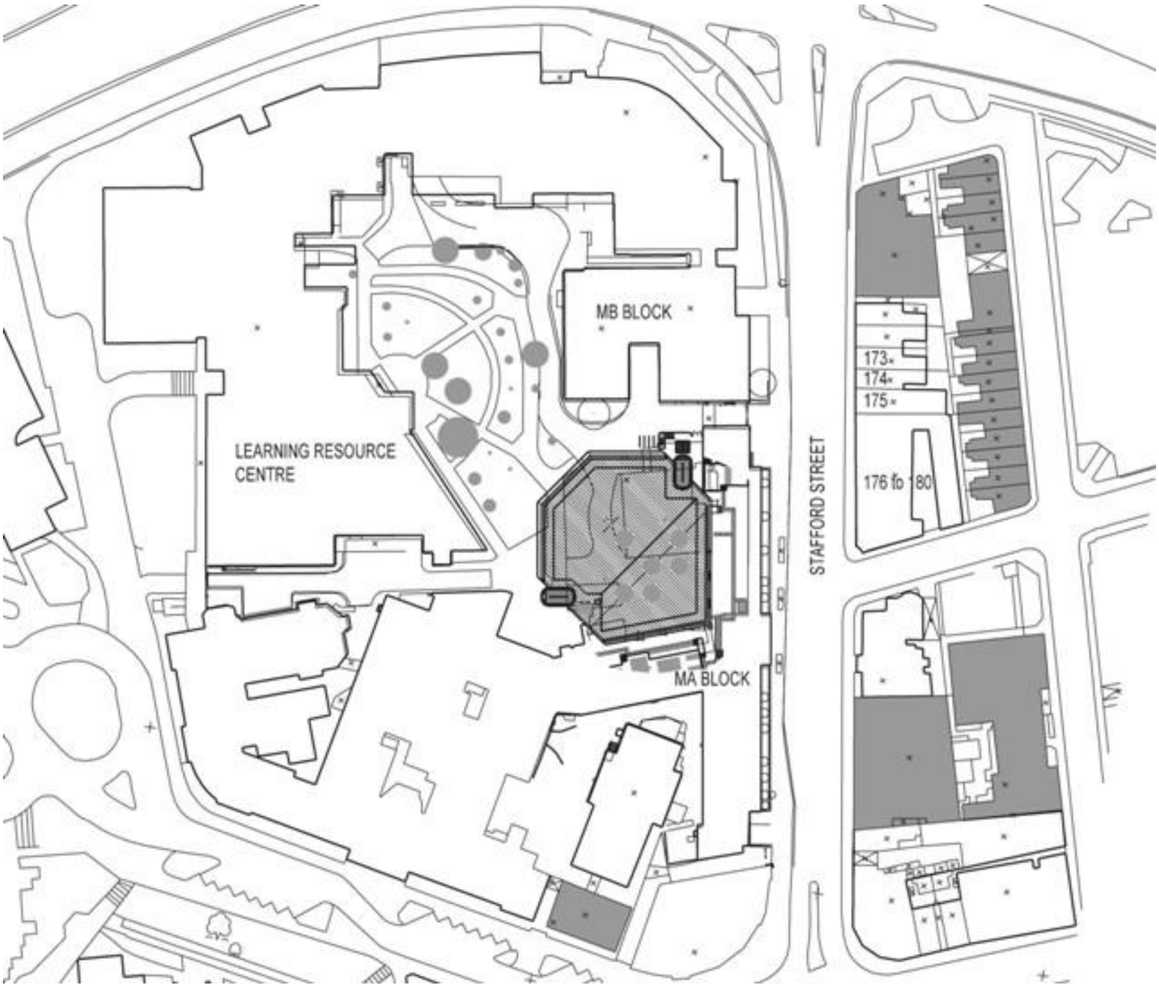


Figure 8.1b, S001 Site plan.

Source: University of Wolverhampton Project Office; ICE Awards 2006 Entry

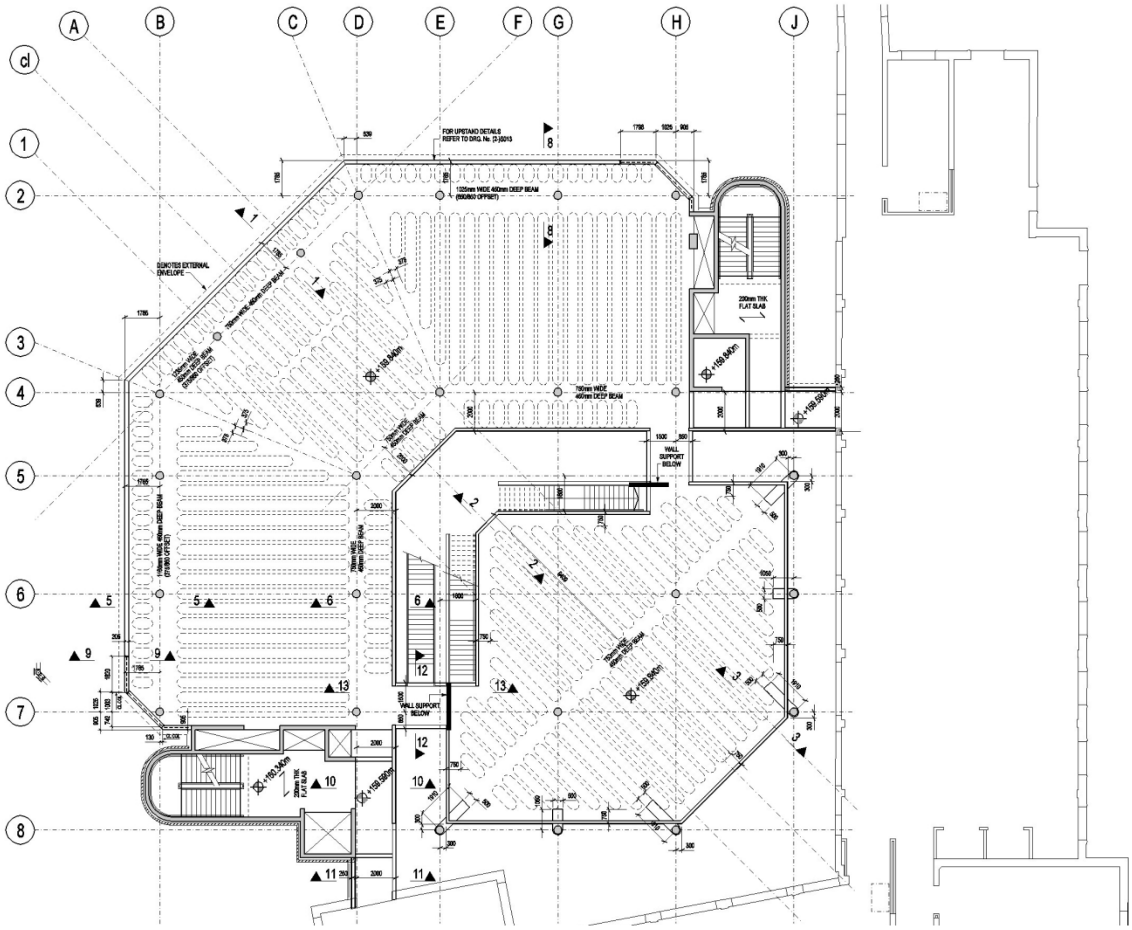


Figure 8.1c, S001 First floor plan.

Source: University of Wolverhampton Project Office; ICE Awards 2006 Entry

Project Strategy

The MI Building was built as a result of the recommendations made in the master plan on the need for a new 5000m^2 IT building within the courtyard of the City Campus. At which time, two academic SCIT and SEBE were located within spaces that were considered to be ‘unfit for purpose, un-inspirational and unattractive’.

The stakeholders (client) had an academically driven strategy for their estate development; which was to combine undergraduate and postgraduate education levels with ‘research and development and commercial consultancy within contemporarily designed spaces. The client also desired to create ‘intelligent’ buildings and thus become an ‘intelligent’ institution through the use of design, infrastructure and purpose. The Client wanted an iconic, functional and reasonably priced building that was open and transparent with a high degree of legibility for all users; a highly flexible building design incorporating open plan areas that would maximize space efficiency; Greater levels of interactions by its shared spaces both in terms of staff offices and general learning spaces (ICE Award bid documents 2006).

The client had the challenge of the use of “new teaching and learning methods, sharing and networking, group working and self-directed study.” This was a big change from rigid enclosed learning and teaching spaces that were tutor controlled. In addition, the client wanted to stop reoccurring expenses and low quality assets and rather develop high quality specialist laboratories that offered users’ the opportunity to develop skills through the use of updated, futuristic and contemporary facilities. The Client therefore wanted a structure that will boost the University’s image and function as an outstanding marketing medium. Figure 8.1d is the approach view from the building’s entrance.

Figure 8.1d Approach view of MI Building:

Source: - University of Wolverhampton Project Office; ICE Awards 2006 Entry

Purpose and Function.

The building was intended to be a multifunctional technology rich learning environment that combined various user patterns that met the client's requirement for the present and future users. It was described as a simple building with high levels of visibility. It created a feeling of altitude/depth and vast space. The concrete ceiling slabs were sculpted with undulating soffits which operated as heat sinks, absorbing excessive heat from the large quantity of IT installations, i.e. computers, printers, scanners, etc. the form of the structural slab helps diffuse reflected sound whilst adding subtlety to the overall lighting effectTable 8.3 is a summary of findings it shows the case study facts and figures as at the time of conception.

Table 8.3 New Technology Building Case Study Facts and Figures

Name	The New Technology Building, University of Wolverhampton (MI Building)
Type	New Build Construction+ Refurbishment and Demolitions
Brief	Prepared by Client and Architect
Gross Area	5000m^2 (New Build)
Cost	£10,000,000 (New Build) + £5,822,000 (refurbishment and demolition works.
Time Scale.	August 2001 – August 2004 (expected)
Good design example identified	Technology supported multipurpose social learning environment, flexible spaces, open plan, user-led teaching and learning environment, adequate lighting, and temperature control, combination of new build and renovation works that resulted in a wow iconic structure.

Source: - University of Wolverhampton Project Office; Horizon Master plan update 2000

8.3.2 Case Study II - University of Northumbria, UK

Case study of the Northumbria University, was selected because it fulfilled the research focus of showing **'the impact of e-learning on facilities and design' as well as 'the design of future spaces and how we get there'** the investigation involved the study of the school of the built environment, virtual environment, & the Student Hub area, Ellison building

Date visited: - 12-11-07 **Contact person**: - Senior Lecturer- School of the Built Environment

Introduction, Background and Context

The Student Hub is located within Ellison Building on Northumbria University's city campus. It is an open plan, open access learning environment. Six years ago the space the Hub now occupies was a faculty office for administration. Change in management led to the new design. The Dean of the School of the Built Environment, at this point in time, was a Chartered Surveyor and had a key interest in developing a good student learning environment. He therefore initiated the change which has subsequently received a positive response.

The new Virtual Environment is also located in Ellison Building. It was developed to help with the integration of emerging Virtual Reality (VR) technologies in the School. The space used to be staff offices with a store and filing cupboard. The change was undertaken three years ago. The School developed a strategy for the integration of 3D modelling into its curriculum and acknowledged that the time was right to begin an implementation of VR, based on an assessment and identification of teaching and learning needs.

The main users of these spaces are the students of the Built Environment. The areas are intended to encourage collaborative learning and are used for project work and also for presentations on module assessments.

Design brief development: This was jointly produced by the School of the Built Environment and the University Estates.

Design & project management: The project management team were in-house. The Estates & Facilities Department created the spaces. The procurement of equipment e.g. the VR hardware was subcontracted.

Technology, open access wireless, IT equipment, communication

The Virtual Environment is PC-based and has two Christie digital DS 300 lumen projectors and a large VR screen and software to support usage. The facility can seat up to 20 people; a computer area at the rear of the facility has six work stations for student project / development work. The system installed was a Stereo Works DPL passive projection system that is connected to the projection system.

The Student Hub has wireless access and provides a laptop loaning system, managed by two staff.

Success factors- the project team had a good working relationship with staff of Estates.

The Architect, Designer or Visionaries (E-learning champion): These were staff of the School and Estates department.

Type of construction: These were mainly refurbishment and renovation of spaces within the Ellison Building.

Description of Spaces: The new Virtual Environment is a flexible space with staff and student users; it is adaptable for meetings. A wall was knocked down and replaced with floor to ceiling glazing, thick curtains were also fitted.

Function of space; the Virtual Environment is a specialist teaching and learning area while the Hub serves as a social area that encourages inter-disciplinary learning.

Design/ Purpose

The idea for the space refurbishment was brought about by a change in management. At that time the Dean of the School was a Surveyor who had a keen interest in developing good student learning environments. He was the main driver for the change and oversaw its implementation. The change was completed four years ago.

How has the learning space improved teaching and learning experience?

- The Virtual Environment is used by staff and students for design exploration and presentations. The system enables interaction with three-dimensional models of buildings, sites and urban spaces and offers the experience of 'being immersed' in a simulated environment.

Design outcomes/ Measurable outcomes

- The Virtual Environment has benefits that are quantifiable; there has been increased consulting and marketing benefits. Discussions are on-going in relation to city modelling. The School is now experiencing the benefits of a cheaper technology than was available five years ago. Upgrading the learning experience of students was the main focus of the project. They have been able to meet the needs of its users and now other benefits are emerging. Pictures are as shown in Figures 8.2a-c.

- **"The facility will enable the exploration of possible benefits of VR across a wide range of built environment projects. The psychology of building spaces, visual environmental impact assessment studies and urban analysis are some of the applications of VR to be developed in the future**.*"* (Senior Staff participant 1- interview, University of Northumbria 2007)

Figure 8.2a the newly created Student Hub

Source © University of Northumbria

Figure 8.2b the New Virtual Reality Suite;

Source: ©University of Northumbria

Figure8.2c. shows Students using the Virtual Reality Suite equipment.

Source ©University of Northumbria

Conclusions & Recommendations

The overall design of the VR studio and hub has been said to be effective, efficient and functional as it meets the users' requirement. Below is a summary in form of a table 8.4 that identifies relevant facts and the best practice example about this case study.

Table 8.4 Summary of Findings from the University of Northumbria Case Study

Name	Northumbria University, Virtual Environment & the Student Hub Ellison building
Type	Refurbishment and renovation works
Brief	Prepared by client and University Estates
Cost	CLASSIFIED
Time Scale.	1year and three months
Good Design Example Identified.	Involvement of staff and member of Estate department helped to control cost resulting in a satisfactory outcome for all. The fact finding trip to other institutions helped to give a broader scope for the design of the new VR facility. The increased level of space use attests to the success of the hub; along with some increased consulting and marketing benefits due to the new VR space and e-learning facilities it provides.

Source: Northumbria University

8.3.3 Case Study III- University of Loughborough, UK

Two buildings were investigated a) the engCETL building and b) Case Study of the Sigma Mathematics Learning Support Centre, Schofield Building Central Park

A) Engineering Centre for Excellence in Teaching and Learning (engCETL) Building University of Loughborough UK.

This case study was selected because it fulfils the research focus of showcasing **'the impact of e-learning on facilities and design'** as well as providing good example of the design of the space types identified.

Introduction, Background and Context

Date visited: - 05-11-07 **Contact person**: - Manager for engCELT

Some of the good aspects seen from this case study were attributed to the success factors which were said to be as follows:

- Good working relationship with university estates as seen in their involvement with the project team.
- Planning time was well organised and adequate
- Involvement of users through workshops and user led discussions,
- Supervisions were thorough
- Project team members put in quality time

The design and structure of the engCETL is a two storey building of precast concrete slabs; enclosing an open building plan /layout without constraints of columns. This layout made the interior spaces flexible and easy to design. The ground floor consists of a lecture theatre which has the capacity to seat three hundred and fifty students.

An increase in number of Postgraduate engineering students led to the need for more spaces; in response to this situation, the faculty of engineering and the University authorities decided to create a postgraduate space within the ground floor area. The first floor spaces include the fluid shaped concourse, a suite of teaching rooms, staff offices and a balcony. See figures 8.3a and 8.3b.

Design, Purpose & function: - The ethos of the design of the new build project was sustainability; the lighting has been set to provide an ambient light source. There was provision for air handling (i.e. recirculation) within the building. Heating and humidity consumption is controlled in all meeting rooms. The walls are painted with magnetic paint-kidi care to reduce maintenance costs as the use of blue tack on walls was not necessary. The building is thought to meet up all the specifications for glazing regulations, thermal qualities are standard, floors are thick. The mesh in front of the building provides solar power for the new build.

The design concept of the new engCETL building is that of an industrial building that aims to change the users' perception to buildings. The approach used was traditional for building/planning.

Figure 8.3a engCETL Building; Staff/ Research students' Office Interior with Open Plan Arrangement.

Source: Adejumo F.T. ELSD photo gallery, (2007)

Figure 8.3b Flexible Space and Furniture, students love the space.

Photo source: Adejumo F.T. ELSD photo gallery (2007)

The curved fluid design gives access to glass partitioned studios /classrooms, stairs, reception area and services.

Design outcomes/Measurable outcomes e.g.

- There has been indication that the bookings are going up every semester. It was 2 years after the eng CETL building was finished that this case study was investigated.

- There was an increase in the diversity of room usage

- The learning and teaching spaces are being pressured to open earlier and increase time allocated for usage, from 8am - 8pm. The plan is to allow one of the four research students work the after office hours.

Conclusions & Recommendations

The overall design of the new engCETL Building has been said to be effective, efficient and functional as it meets the users' requirement. Below is a summary in form of a table that identifies relevant facts and the best practice example about this case study. A summary table of findings is presented below in Table 8.5

Table 8.5 Summary of findings on the engCETL Building

Name	engCELT Building University of Loughborough UK
Type	New build construction
Brief	Prepared by client and architect
Gross area	550 square meters space (18m x 30m)
Cost	4.5 million
Time scale.	Executed over the summer holidays this took about a year for planning and 6months to completion
Good design example identified.	Involvement of users and industry partners in the project resulted in a satisfactory outcome for all. The increasing recruitment trend and high level of space use attests to the success of the project; along with some unplanned benefits due to the new build and e-learning facilities it provided.

Source: - Loughborough University

B) University of Loughborough - Case Study of the Sigma Mathematics Learning Support Centre, Schofield Building Central Park. The case study was selected because it fulfilled the research focus of handling **'the security issues of e-learning and e-learning space design, and the levels of design risk in an e-learning**

infrastructure' most importantly; it is an example of 'inclusive design and its future direction'

Date visited: - 05-11-07 **Contact person**: - Assistant Director Sigma Centre for Excellence in Mathematics and Statistics Support, Loughborough and Coventry Universities.

Some of the good aspects of the case study identified were attributed to the Success factors which were stated as follows:-

- The project was guided by the University's policy for delivering construction projects.
- The project manager, who is a Member of Estates Department, carried everyone along; the tutors, the receptionist and students as it was agreed that the new support centre would provide services to students from other departments, hence the inclusion of the wider student and staff user population. This encouraged team work. The project Manager also invited project committee members and Consultants round to see the space. This encouraged input of relevant suggestions.
- The IT Department Staff were involved in the purchasing of IT equipment, and gave relevant advice on installation of equipment.
- Project strategy was developed in-house. The project team consisted of the key stakeholders from SIGMA and the MLSC, Architect; Designer or Visionaries (E-learning champion); Staff of the Estates & Facilities Department.
- In order to enhance the university-wide approach, a project was developed with LUSAD (the University's School of Art and Design) to provide textile and print designs to decorate the new space. This was included as part of a core module and the winning designs were used throughout the Centre. Figure 8.3c below is a picture showing the disabled stair lift to the upper level; a recent addition to the construction in the centre.

Figure 8.3c Stair lift to upper floor for disabled users Loughborough University Sigma Mathematics Support Centre: source Adejumo F.T ELSD photo gallery, 2007

How the new e-learning space improved teaching and learning experience

In order to engage students in seeking help from the math support centre, it has been designed to provide multifunctional services;

I. Drop-in centre for any student (anonymity is ensured)

II. Teaching and learning environment, that offered a time tabled tutor support

III. A relaxation area for staff was created and fitted differently replacing the former situation where staff used to talk in the kitchen or hang out along the stairs and corridors during their lunch breaks.

IV. Staff still retained their individual offices which they, as academics preferred.

Conclusions & Recommendations

The overall design of the new drop-in centre at the Schofield building has been said to be effective, efficient and functional. Below is a summary in a table format, highlighting relevant facts and some good examples from the Sigma project. Table 8.6

Table 8.6 Summary of Case Study Findings on the Sigma Support Centre

Name	The Mathematics Learning Support Centre, Schofield Building, Loughborough University
Type of construction	Refurbishment of spaces
Brief	The brief was prepared by the University Projects Committee for the Sigma project and Design team
Cost	1.575 million pounds
Time scale	Executed over the summer holidays this took about a year for planning and 6months to completion
Good design example	Provision of good sized flexible learning spaces. Fitted with robust furniture and new technology equipment; user led design; inclusive design considerations implemented; e.g. the Eureka Centre. The project came in slightly under budget resulted in financial savings used for the purchase of additional technological equipment.

Source: - Loughborough University

8.3.4 Case Study IV- University of Essex: The Southend Campus-

This case study pictured in figure 8.4 was chosen as it was considered to have successfully addressed the research focus **of Security issues of e-learning and e-learning space design.** Also it fulfils the case study criteria on the use of technology within the space design. A summary of how this was achieved is presented hereunder.

Date visited: - 03-12-07 **Contact persons**: Deputy Director of Estates, Hub Manager and an IT Officer

Introduction, Background and Context

The building was opened in January 2007 and it is located off the high street in the centre of Southend-on-Sea in South Essex. It provides contemporary state-of-the-art learning and teaching facilities in a business environment setting as well as a Business Hub – with Conference Rooms within an active town centre location. Some best practice aspects identified about this case study are stated below.

- Flexible project management approach was used for the delivery of the structure.
- Good working relationship with design team and consultants
- The team worked with a realistic budget based on sufficient funds
- There was an understanding of what the clear goal of the project deliverables were
- The project was made up of phased construction in order to give room for changes.
- It was still on-going at the time of investigation
- Provision of Physical security of facility in order to manage the design risk posed by the site location. Such devices such as access control, CCTV cameras were in place.

Figure 8.4a Approach View of the Southend Campus of University of Essex;

Source- University of Essex

Design & project management team; - external project managers were employed and used for the delivery of the project i.e. Dudley Smith Partnership (DSP).

Technology: this was built into the design from the onset.

Architect; Designer or Visionaries (E-learning champion); consultants

In-house Estates staff and external Consultants; The Architects /Designers were SMC Charter Architects and Peter Emptage Architects.

Type of construction: - New build with space for future expansion and fit out

Design, Purpose & function

- **Design:-** The structure is made of steel frame with a façade of structural glazing cantilevered onto a freeform column
- **Purpose:** - Built to serve the dual purpose of becoming a centre for educational excellence and a source of economic regeneration and business development within South Essex in line with the Thames Gateway Regeneration Programme.

The main project driver. The Thames Gateway Regeneration Programme was the main driver behind the new build along with the external grants and funding.

How has the learning space improved teaching and learning experience?

- The new build affords learners the exiting experience of a new approach to teaching and learning in a creative, high tech, user friendly environment. New courses, new facilities, dynamic culture, on-going flexible change process have been combined to give learners a unique experience

- The Business incubation units are an innovative approach for upcoming entrepreneurs' it also provides a first-hand experience for the students of the Business school

- The Dental Clinic facilities have standard equipment for hands on training as well as free health services for students.

Design/measurable outcomes

- The building won an award for regeneration and sustainable development.
- They had a very realistic budget and worked within it.
- 12,300m^2 space was achieved. Everything was developed from scratch.
- The benefits of having access to the 'i-Lab' has had such an impact at the University of Essex that it has invested in a second lab located at its Colchester campus.

Conclusions & Recommendations

There was no Library within the new build, students have to register online and visit the Albert Sloman Library (ASL) at the Colchester campus, or the nearby South East Essex College (SEEC) in Southend to gain access to library facilities. Table 8.7 below is a summary.

Table 8.7 Summary of findings from University of Essex-South-end Campus

Name	Southend Campus University of Essex
Type	New build construction
Brief	There was no absolute, used a flexible approach, design team and architect
Gross area	12,300m^2
Cost	£27M
Time /duration.	August 2004-January 2007
Good design example identified.	New design approach employed, phased delivery of a mixed used building; combining, academic and commercial within a business environment; BIC, BDU, i-Lab, flexible spaces, flexible furniture, state of the art technology, satisfy user requirements, ongoing change process

Source: University of Essex-South-end Campus

8.3.5 Case Study V- Leeds Metropolitan University, UK.

The study investigations involved the Jane Graham Building, the Coach House & the Carnegie Stand. Date visited: - 28-11-07 **Contact persons:** - Senior Lecturer.

This case study pictured in figure 8.5a-b was chosen as it was considered to have successfully addressed the research focus **of Designing for the- learn anytime, anywhere paradigm.** A summary of how this was achieved is presented hereunder. Some best practice aspects identified about this case study are stated below

- Different user learning styles could be identified within the same spaces investigated as shown in figures 8.5 a and 8.5b
- The success factors were said to be attributed to:-
- Phased project done in bits over summer breaks
- Adequate funding from the University Capital Funds
- Definition of a clear and achievable project strategy which was ‘to upgrade teaching and learning spaces facilities and technology in order to improve learning outcomes and increase user satisfaction’.
- Provision of open access and wireless
- Mobile learning was achievable
- Different user patterns within the same study environment

- Provision of open access and wireless internet
- No restrictions imposed on learners

Introduction/ Background & context

Some of the problems identified with the teaching and learning spaces were that the institution was not providing enough spaces for the students, there were a lot of closed doors in a lot of areas, and it was decided that there was a need to turn those spaces into usable areas. Technology wise, the Institution aimed to teach students how to use computers.

All this was in line with the new VC’s strategy to upgrade the University facilities and technology which then led to the execution of a number of refurbishments, renovations, upgrades and new builds. Notable amongst this are; the Jane Graham Building, the Coach House and most significant is the redevelopment of the Carnegie Stand.

A) The Jane Graham building – This is the main learning centre/library in the Leeds Met campus. It is an example of development of various types of study spaces within one building.

Figure. 8.5a Leeds Metropolitan University Jane Graham building; Ground floor study spaces

Source: © ELSD photo gallery by Adejumo F.T

Figure 8.5b Leeds Metropolitan University Jane Graham Building Group Study Spaces
Source: © Adejumo F.T. ELSD-photo gallery (2007)

B) The Coach House pictured in figures 8.5c-e is an example of an informal learning space newly refurbished and developed. This was a dead space that was not in use at all. It was refurbished over the past year (2007).

Figure 8.5c Leeds Metropolitan University Coach House Building; Business & Enterprise for MBA students

Source: © ELSD-photo gallery by Adejumo F.T (2007).

Figure 8.5d. Leeds Metropolitan University Coach House Building.

Source: © ELSD-photo gallery by Adejumo F.T

AV equipment, networked to white boards, display screen and computer (figure 8.5d).

C) The Redevelopment of the Carnegie Stand

The redevelopment was as a direct outcome of the Headingly Carnegie between the Yorkshire County Cricket Club, Leeds Rhinos/Tykes Rugby team and the Leeds Metropolitan University.

Figure 8.5e Carnegie Stand with contemporary glazed façade of Teaching Facilities

Source: © ELSD-photo gallery by Adejumo F.T (2007)

Design & project management team, (In-house estates & facilities personnel)

The refurbishment works involved input from in-house estates and facilities staff. Major renovations were outsourced to consultants.

Technology - Open access wireless, IT equipment, Communication, Document readers, RHP scanner, Computers, DVD, sound systems, Cameras, TV studio facilities for students' presentations.

In the Refurbished Coach House there is a flow between spaces, defined by flexible furniture arrangement which allows for collaborative, group learning.

In the Jane Graham Building, closed spaces have been opened up to provide social study spaces, silent study areas are enclosed.

In the Carnegie stand, lecture rooms and tutorial rooms are enclosed:

Design / Measurable outcomes:-

At the Jane Graham Building, - there are better user spaces available to learners with various space layouts. Lecture theatres A&B have 89% usage. The social learning /group study spaces have shown increased user numbers, however the silent study environment in the library is still sparsely used. The upgrade on technology was a welcome improvement.

At the Coach House, there was a notable positive impact of the new space on the students offering MBA at the school of Business and Enterprise as the new spaces now affords students a better learning environment.

Table 8.8 summary of findings Leeds Metropolitan University

Name	Leeds Metropolitan University UK
Type	new build construction & refurbishments
Brief	prepared by client and architect
Gross area	
Cost	Classified
Time scale.	An ongoing development done within the past 5yrs
Good design example identified.	One of the best aspects of the design is the flexibility of spaces, to encourage various activities, also the specialized user spaces in the Carnegie stand which is a sustainable structure.

Source: Leeds Metropolitan University

8.4 DEVELOP THE CONCLUSIONS, RECOMMENDATIONS AND IMPLICATIONS.

8.4.1 Discussion.

From the interviews conducted during the case studies: - some participants felt that **collaboration between HEIs was non-existent, with no information for benchmarking hence HEIs often relied on their in-house Estate and Development Staff to handle construction projects.**

Also User involvement was often unwelcomed and as it were, most projects were` executed with little input from the space users. However, some form of interaction and feedback was in place as seen in most of the cases investigated.

The lack of space or the available funding was seen to be responsible for construction projects. However, the major project drivers were based on Institutional led factors rather than user-led factors.

- From case studies:- Three user groups i.e. Staff, students/visitors and stakeholders such as University Executives, Directors of Estate, Designers, Financiers and E-learning champions were also identified which also verifies the initial findings from the forums and pilot studies.

- During the site based analysis, users were observed within spaces such as learning centres/ libraries, student zones/social facilities, accommodation facilities, lecture theatres, sports halls/stadium and outdoor learning environments. From the studies it was discovered that there is a need for knowledge share with respect to e-learning space design in HEI construction.

- The case studies show that there was an increasing shift towards achieving a student focused learning environment though issues of security, risk, varied users and their different learning patterns suggested that it may not yet be possible to provide a perfect design solution suitable for all users.

- The users observed that there was a need for open discussion and exchange of ideas/ opinions; future collaboration between HEIs in order to provide realistic benchmarks; foster dialogue between users, designers and stake holders from the inception of design projects as part of the strategic project planning of institutions.

- Users and learning patterns were seen to be varied and constantly changing. Based on variables such as demography i.e. age, gender; course, background i.e. social, economic, cultural, ability levels. **This also goes to prove that hypothesis No 2 is true**.

- Types of technology provided within the learning environment: standard provisions include internet access, printers, copiers, fixed data projectors, networked PC, laptop and USB inputs, DVD/VHS facilities, touch screen interface as well as an IP phone with an AV hotline service, VLE facilities. Most of the technology provided were mainly upgraded after the spaces had been designed resulting in ineffective space use in some cases. However some structures had the technology incorporated as part of the space design from the onset.

- Some of the design variables considered to be important aspects of the spaces investigated /Space design factors were: functionality, form, flexibility, layout/planning, materials and finishing’s, lighting, ventilation, circulation/accessibility, acoustics, aesthetics, type of construction or facility: new-build, renovations, extensions etc and furniture types were.

- Security issues affecting some of the design of spaces were: theft of books and damage to facilities. However the majority of cases seldom experienced these and had features in place to prevent and minimise occurrences such as CCTV cameras, swipe cards, beeping alerts, provision of adequate lighting along corridors, entrance restrictions to certain places, and security personnel.

-Risk identified within/during e-learning space design projects and how to minimise these were issues such as: going over the budget and project duration/time. The safety and suitability of end product for the users were some of the concerns expressed by the interviewed respondents.

- The case studies investigated also showed that the space design had an impact on the technology, the users learning experience as well as the functionality of the learning environment.

- There were inclusive design features in some of the new build designs and renovated structures but there was a need for greater consideration for these in future space designs

- The ‘learn anytime anywhere scenario was an aspect of space design that was not in place in most of the cases investigated, however, some of the spaces allowed for blended learning and multipurpose functions.

8.4.2 Case Study Recommendations and Implications.

From literature reviewed it can be understood that ‘the reporting aspect of a case study is perhaps most important from the user perspective’ as this was ‘the contact point between the user and the researcher’ (Tellis 1997).

1. It therefore means that a properly designed research project which lacks adequate explanation for the benefit of the reader, could cause the research report to be considered irrelevant (Tellis 1997).

2.The researcher is therefore expected to avoid ‘technical jargon and resort to clear explanations an opinion also expressed by Bell, (2005) and Denscombe (2007) as it is an important part of the study that the readers understand the implications of the findings.

3. A key aim of case study research weather it is intrinsic, instrumental or collective is to offer a wealth of readable detail and analysis, such that the reader can make a judgement about the case (Cousin, 2009).

4. Furthermore, Cousin (2009) noted that it is difficult to be prescriptive about the design, implementation and analysis of case study research because it is a messy business involving a degree of connoisseurship (Eisner, 1991 in Cousin 2009) which means, ‘a nose for an emerging focus, a supportive theoretical literature, exemplary stories and vignettes,

appropriate methods to use, analytical moves to make, data to shed or keep and write up flair' (cousin, 2009; pg. 137).

Therefore from the fore going, and in addition to the discussion in section 8.4.1, the implication from data collected on case studies done were as follows

- The research hypothesis two as well as objective two were adequately satisfied and proved to be true as seen from the case studies done. However,
- All HEI investigated was in the process of changing their learning environment to suit the type of technology adoption, space and users requirement.
- Funding was a major driver for space design projects executed
- The duration for most projects was often over the summer holidays, while others were on-going during term time, but phased delivery of projects was being used.
- The effect of space design on users learning patterns were perceived positive in most cases.
- Architects/Designers were often employed as well as in house estate / facilities staff
- Users were seldom involved in space design projects, but feedback questionnaire were used in some instances post project delivery.
- The functionality of spaces was often judged by its flexibility, adaptability and frequency of use resulting in need for time tabling in some cases to control users.
- There were several concerns with the sustainability, design risks and security of spaces with respect to technology changes, provision of suitable facilities and future users' requirement
- Inclusive design issues were apparently being considered and seen to be included in the new build design in some cases but as an afterthought in already existing builds.

8.5 CHAPTER EIGHT SUMMARY.

This Chapter presented a brief summary of the case study findings of five HEIs investigated and how the procedures and recommendations for case study methodology as a data gathering tool was applied. A general understanding of the case study methodology for data collection was also discussed. The different studies were selected based on the three case study criteria developed. The findings showed that each case study dealt with the various aspects of the research focus and the results also proved that hypothesis No-2 was true. The findings indicated that most of the construction works were institution led and users were often not involved in the design process. Some implications were also discussed among which concerns about the sustainability, design risks and security of spaces with respect to technology changes, provision of suitable facilities and future users' requirement were noted.

The types of spaces identified in line with objective two were mainly multifunctional, group, blended and social learning spaces as well as specialised user spaces.

CHAPTER NINE -ANALYSES, DEVELOPMENTS/INFERENCES FOR THE FRAMEWORK AND RESEARCH IMPLICATIONS

Section three- it is the analysis of the field work, how it was used in the development of the framework leading up to the final outcome of the study. This started in **chapter nine** and concludes in chapter ten.

9.0 INTRODUCTION

This chapter is dedicated to the implementation of the analytic strategy for the data analysis. The analytic strategy used combined both qualitative and quantitative approaches, the quantitative data analysis was in form of descriptive statistics method; while the qualitative data were assimilated using Case study and analysed by Content and Thematic analyses in order to present original and in-depth outcomes as these were considered to be the most adequate to meet the needs of the research.

Thus, the application of Yin (2009) procedures and consideration of arguments put forward (see chapter six) on the analytic technique for the qualitative data gathered during this study has helped to shape the analysis presented hereunder.

The chapter also discusses the developments and inferences of the research findings and recommendations towards the development of the framework and the proposed 'How-to-design guide'. Architectural illustrations with explanation of how these can be adapted are presented in chapter ten.

9.1 DATA ANALYSIS- DEVELOPMENT OF FRAMEWORK CONSTRUCTS

The frame work developed from the data analysis of the findings follows the example of similar research combined with the components of the case study selection criteria and guidelines.

The similar research considered was that of Broadley (2007) (on *'The implementation of e-learning*: *A case study of three schools in Australia'*). The frame work developed by Broadley (2007) was basically due to expectations that it would be outlined by '*the resource, pedagogies and delivery strategies components'*(Fox & Trinidad, 2006 in Broadley 2007) Figure 9.1 illustrates their structural frame work and concept.

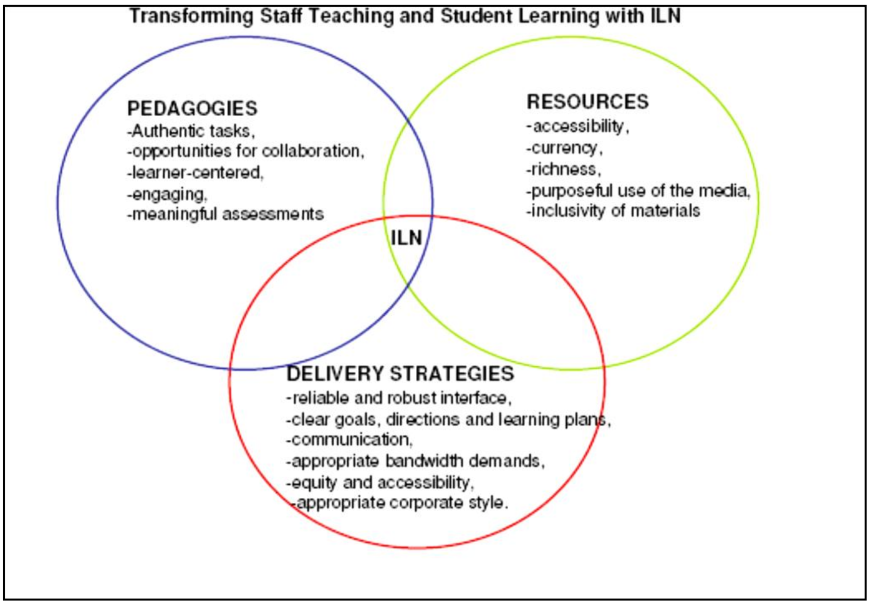


Fig 9.1 Venn diagram of The Structural Frame work Developed by Fox & Trinidad (2006)
Source: Broadley (2007)

Further to this, the explanation of how the criteria developed, for the analyses of findings were developed into the framework is presented here under, the criteria developed (in section 6.9.3.1) were:-

I. Criteria One: - Type of Space identified within HEI Campuses

II. Criteria Two: - The Technology Use and Adoption within the Design of E-learning Spaces

III. Criteria Three: - E-Learning Space Design Research Focus (ELSD Focus)

The relationship between the above categories for the model for e-learning space design is shown in Figure 9.2 which illustrates the relationship between them as factors that impact on each other within the context of the research aim. It was thought that the relationship between the components was such that the design of **space types** with consideration of the **ELSD research focus** would **ensure the effective identification, interpretation and delivery of users' requirement while maximising the benefits of the use and adoption of appropriate technology** within HEI facilities. This was therefore proposed as the realistic process, framework/model that will provide guidance for future delivery of efficiently designed E- learning Spaces (TSL) in HEI campuses.

These three categories became the construct for analysing the quantitative data obtained from the questionnaire surveys albeit with a detailed explanatory approach in order to present information about user requirements, preferences and opinions.

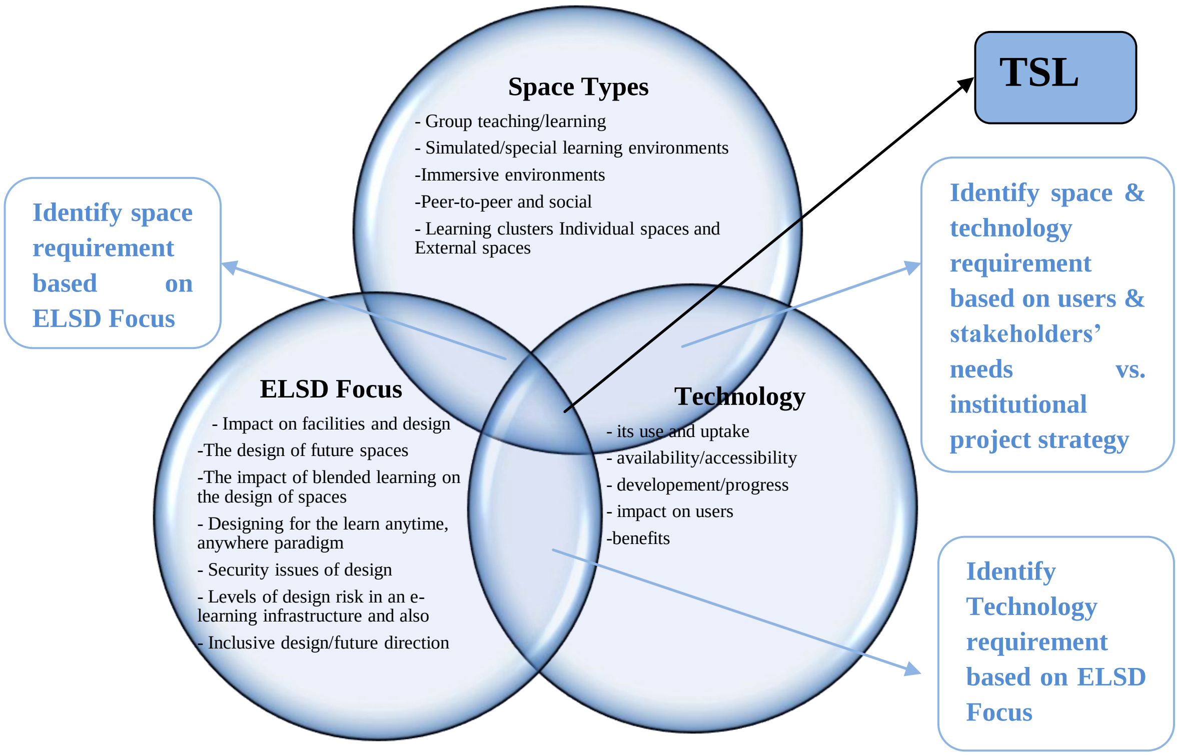


Figure 9.2 The ELSD Framework Developed for Delivering an Ideal TSL Environment

Furthermore, the interpretation of the relationship between the categories was also supported by the response obtained from the users' and designers survey on 'Space design' and its impact on teaching and learning outcome. For example the response given to question on what users **understand by the term 'an e-learning space or technology supported learning environment'** from the Users' survey in Table 9.1

Table 9.1 User's Definition of an E-Learning Space

Options for the definition of an E-learning Space	Percentage of respondents	Number of Responses
a) A space that incorporates social activities with informal learning facilities like a cyber café for blended learning	11.1	8
b) A space that has been fitted with IT facilities, digital technology and media for teaching & learning only	22.2	16
c) A space that has been fitted with technology supported learning facilities with inclusive design consideration for ease of accessibility and usage by all	30.6	22
d) A space fitted with flexible furniture, IT and technology for multipurpose usage	19.4	14
e) Learning through online (virtual) facilities only e.g. long distance learning	12.5	9
f) Other (please specify)	4.2	3

The results obtained indicate that 30.6% (22 respondents) thought that it was **'A space that has been fitted with technology supported learning facilities with inclusive design consideration for ease of accessibility and usage by all'**.

Three other responses on the users' understanding of what the term an e-learning space or supported learning environment were as follows:-

- 'An interactive studio'; facilities for distance learning e.g. video conferencing'

- 'A combination of virtual space and physical space with facilities for both face to face' and

- 'Virtual contact for collaboration, sharing and using digital resources'.

Similarly, five designers of HEI buildings were also invited to participate in the survey. A similar question was asked with respect to their understanding of an e-learning space, the response given was as in Table 9.2

Table 9.2 Definition of an E-Learning Space Design from Designers of HEI

Options for the definitions of an e-learning space	Percentage	Responses
a) A space that incorporates social activities with informal learning facilities like a cyber café for blended learning	23.1	3
b) A space that has been fitted with IT facilities, digital technology and media for teaching & learning only	15.4	2
c) A space that has been fitted with technology supported learning facilities with inclusive design consideration for ease of accessibility and usage by all	23.1	3
d) A space fitted with flexible furniture, IT and technology for multipurpose usage	30.8	4
e) Learning through online (virtual) facilities only e.g. long distance learning	7.7	1
f) Other (Please Specify):	0.0	0

The results showed that four (90%) of the respondents participated. (30.8%) felt that it was a **'space fitted with flexible furniture, IT and technology for multipurpose usage'** while three of the respondents (23.1%) felt that it was **'A space that incorporates social activities with informal learning facilities like a cyber café for blended learning'** as well as **'A space that has been fitted with technology supported learning facilities with inclusive design consideration for ease of accessibility and usage by all'**

9.2 ANALYSES OF CASE STUDY RESULTS BASED ON- SPACE TYPES AND DESIGN FACTORS

From Table 6.3 which showed the categorisation of space types and factors that influenced the design as identified in the study. The categorisations developed were then used in Table 9.3 which indicates where the space types were seen in the case studies done in line with the simple coding of data developed.

Table 9.3 Comparison of Space Types /Factors That Influenced Space Design

Space Types Identified from desk studies	Factors for space design (FSpd) I- User Led; II Technology led; III- Institution led; IV- Unplanned design.				
	Case study 1 University of Wolverhampton	**Case Study 2 University of Northumbria**	**Case study 3 University of Loughborough**	**Case study 4 University of Essex- South End Campus**	**Case study 5 Leeds Metropolitan University**
space type 1- Group general teaching/learning space	**II** - Technology led design and **III**- Institution led design	Not seen	**I** – User led design and **III**- Institution led design	**II** - Technology led design and **III**- Institution led design	**I** – User led design and **III**- Institution led design
Space type 2- simulated/specialised learning space	**II** - Technology led design and **III**- Institution led design	Not seen	**I** – User led design and **III**- Institution led design	**II** - Technology led design and **III**- Institution led design	**I** – User led design and **III**- Institution led design
Space type 3- immersive environments	**II** - Technology led design and **III**- Institution led design	**III**- Institution led design	Not seen	**II** - Technology led design and **III**- Institution led design	**I** – User led design and **III**- Institution led design
S**pace type 4**- social/peer to peer learning space	**II** - Technology led design and **III**- Institution led design	**III**- Institution led design	**I** – User led design and **III**- Institution led design	**II** - Technology led design and **III**- Institution led design	**I** – User led design and **III**- Institution led design
Space **type 5**- learning clusters	**II** - Technology led design and **III**- Institution led design	**III**- Institution led design	**I** – User led design and **III**- Institution led design	**II** - Technology led design and **III**- Institution led design	**I** – User led design and **III**- Institution led design
Space type 6- individual spaces	Not seen	Not seen	Not seen	Not seen	**I** – User led design and **III**- Institution led design
Space **type 7**- external spaces	**II** - Technology led design and **III**- Institution led design	Not seen	Not seen	Not seen	**I** – User led design and **III**- Institution led design

The interpretation of the above data in tables 6.3 and 9.2 are as follows:

a) **Sp. type 1** is the code meaning **'space type 1'** which in turn refers to- **Group teaching/learning space**

b) **Sp. type 2** is the code meaning **'space type 2'** which in turn refers to **simulated/specialised learning space**

c) **Sp. type 3** is the code meaning **'space type 3'** which in turn stands for **'immersive environments'**

d) **Sp. type 4** is the code meaning **'space type 4'** which in turn stands for **social/peer to peer learning space**

e) **Sp. Type 5** is the code meaning **'space type 5'** which in turn stands for **learning clusters**

f) **Sp. Type 6** is the code meaning '**space type 6'** which in turn stands for **individual learning spaces**

g) **Sp. Type 7** is the code meaning **'space type 7'** which in turn stands for **external learning spaces.**

In the same way, the interpretation for data in column two relating to the factors that influenced the different space design have also been assigned simple codes as well

FSpd Is the general code meaning '**Factors that influenced the space design'** these were considered to be four factors **denoted I-IV, t**herefore:

a) **User led design factor** is coded as **'FSpd-I'**

b) **'FSpd-II'** stands for **'Technology led design'**

c) **'FSpd-III'** stands for **'Institution led design'** and

d) **'FSpd- IV'** stands for **unplanned space design**

<u>Interpretation of simple coding used for space types and design factors:</u>

CASE STUDY 1- (University of Wolverhampton):-The **space types** seen here were **1**-Group teaching and Learning Spaces**, 2**-Simulated/Specialised Learning spaces**, 3-**Immersive Environments**, 4-**Social/Peer to peer Learning Spaces**, 5-** Learning Clusters **and 7**-External learning spaces.

While the factors that influenced the design of these spaces were **FSpd- II-** Technology led and **FSpd –III-** Institution led factors

From the interview and review of documents, it was stated that **the reason** given for these space types and factors that influenced the space design was that:-

It was **'part of the recent reconstruction works executed by the university in an attempt to upgrade its learning environment and image'**.

CASE STUDY 2- (University of Northumbria):- The **space types** seen here were: - **3**-Immersive Environments**, 4-**Social/Peer to peer Learning Spaces**, 5-** Learning Clusters

Other spaces such as **1**-Group teaching and Learning Spaces**, 2**-Simulated/Specialised, **6-**individual spaces **and 7**-External learning spaces were not seen.

The factors that influenced the design of these spaces were **FSpd –III- Institution led factors**

From the interview and review of documents, **the reason** given for these space types and factors that influenced the space design was due to:-'**Change in management which led to the new design'.**

CASE STUDY 3-University of Loughborough: - The **space types** seen here were: **1**-Group teaching and Learning Spaces**, 2**-Simulated/Specialised Learning spaces, **4-**Social/Peer to peer Learning Spaces**, 5-** Learning Clusters

Other spaces such as - **3**-Immersive Environments**, 6-** individual spaces **and 7**-External learning spaces were not seen.

The factors that influenced the design of these spaces were **FSpd- I- User led and FSpd – III- Institution led factors**

From the interview and review of findings, **the reason** given for these space types and factors that influenced the space design were-: **'An increase in number of Postgraduate engineering students which led to the need for more spaces; also the available CETL funding, along with the University's desire to support students by providing links to industry as well as additional spaces for the new drop-in centres for learning statistics and mathematics.'**

CASE STUDY 4-Universityof Essex:- The **space types** seen here were **1**-Group teaching and Learning Spaces**, 2**-Simulated/Specialised Learning spaces**, 3**-Immersive Environments**, 4-**Social/Peer to peer Learning Spaces**, 5-** Learning Clusters**.**

Space Types 6- Individual Learning and **7**-External learning spaces were not seen.

While the factors that influenced the design of these spaces were **FSpd- II i.e. Technology led and FSpd –III i.e. Institution led factors**

From the interview and review of documents, it was stated that **the reason** given for these space types and factors that influenced the space design were that-: **'The University had an opportunity to facilitate their community into becoming a centre for educational excellence and aimed to have a positive impact on economic regeneration and business development by developing purpose built buildings that will provide innovative, relevant and excellent services that will restructure the social wellbeing of the neighbourhood'**

CASE STUDY 5- Leeds Metropolitan University:- The **space types** seen here were: **1**-Group teaching and Learning Spaces**, 2**-Simulated/Specialised Learning spaces, - **3**-Immersive Environments **4-**Social/Peer to peer Learning Spaces**, 5-** Learning Clusters**, 6-** individual spaces **and 7**-External learning spaces.

The factors that influenced the design of these spaces were **FSpd- I- User led and FSpd – III i.e. Institution led factors**

From the interview and review of documents, **the reason** given for these space types and factors that influenced the space design were-: **'Some of the problems identified with the teaching and learning spaces, such as the provision of adequate spaces for the students, the existence of a lot of closed doors in a lot of areas, and the decision to turn those spaces into usable areas; as well as the Institution's aim to teach students how to use computers, which aligned with the new VC's strategy to upgrade the University facilities and technology. These then led to the execution of a number of refurbishments, renovations, upgrades and new builds'**

9.2.1 Discussion

It was observed that most of the space designs executed were influenced by Institutional led factors. Technology was the leading factor in some instances as well as user led factors. It can therefore be inferred that this may be due to the following:-

a) The institutions' educational systems and the relationship between their e-learning space design; culture or focus as it were. From literature reviewed (in chapter five) some 'educational systems were influenced by the advent and uptake of technology use within the educational sector which research indicates has brought about different new educational system and methods. They include the mobile learning, long distance learning, virtual learning, connected learning, face to face learning and e-learning systems. Thus it can be argued that some institutions are research intensive, teaching or learning oriented while others are technology driven.

b) Another reason could be hinged on an Institution's understanding of the different learning styles of its users which research shows to be categorised into 'Simple non-associative learning i.e. Habituation or Sensitization; Associative learning i.e. Operant conditioning or Classical conditioning; Imprinting, Observational learning; Play; Enculturation; Multimedia learning; E-learning and augmented learning; Rote learning; Informal learning; Formal learning; Non-formal learning; Non-formal learning and combined approaches; Tangential learning; Dialogic learning' (Savin-Baden, 2008; Online Dictionary, 2010).

c) Another reason for the need for more learning spaces could be as a result of increased number of students as seen in case studies of Universities of Wolverhampton, Loughborough and Leeds Metropolitan, as well an institution's desire to impact on the wider community as was observed in case study of University of Essex, could be hinged on the fact that 'in most developed countries a good number of the inhabitants (up to 50%) now enter higher education at some point in their lives'. Thus making 'Higher Education very significant to nationwide economies, both as a noteworthy business in its own right, and as a source of skilled and knowledgeable workers for the entire economy. (HEA, 2005) http://www.excellencegateway.org.uk

d) Furthermore the response to the Survey administered to University Executives also backs up the findings as it indicated that they felt that most space design projects were institution led, and that most of the users preferred the use of 'Multifunctional spaces' in form of 'Social/ Blended Learning Spaces for informal studies' as well as 'Group teaching and Learning spaces'. Also the results obtained showed that most executives were involved with the design or construction of the spaces within their respective institutions. This was evident in the responses presented below to questions 1-4 of the Executive survey as tabulated in Tables 9.4-9.8.

Table 9.4 Results of the Involvement of HEI Executives in Space Design

Answer	**Percentage**	**Responses**
Yes	75.0%	3
No	25.0%	1
	Total	4

Table 9.5 Result of Role of HEI Executives in the Design of Teaching and Learning Spaces

Roles	**Percentage**	**Response**
Client team-specifying brief and requirements	25.0	1
Space Design Initiator/facilitator of projects	25.0	1
Funding/Finance management	25.0	1
Head/Member of the Executive Committee overseeing all aspects of Space Design and Construction projects	0.0	0
Other (Please Specify):	25.0	1
	Total	4

The responses obtained indicate that three out of the four respondents agreed that they had been involved in the design of teaching and learning spaces, albeit in different roles which were 'Client team-specifying brief and requirements, Space Design Initiator/facilitator of projects and Funding/Finance management. The other response given was **'ensuring space and information technology (IT) mesh to facilitate learning'**

The results obtained or the significance of Architecture in certain aspects are shown in Table 9.6 and discussed hereunder.

Table 9.6 Results on the Rating of the Significance of Architecture

Rating of significance	**1**	**2**	**3**	**4**	**5**	**Responses**	**Percentage**
The strategic vision of the University	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	1 (25.00%)	1 (25.00%)	4	3.75 / 5 (75.00%)
The educational system and philosophy of the University	0 (0.00%)	0 (0.00%)	1 (25.00%)	1 (25.00%)	**2 (50.00%)**	4	4.25 / 5 (85.00%)
The level of technology uptake of the University	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	1 (25.00%)	1 (25.00%)	4	3.75 / 5 (75.00%)
The culture of the staff and students of the University	0 (0.00%)	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	**2 (50.00%)**	4	4.50 / 5 (90.00%)
The type of learning and teaching environment the university wishes to portray	0 (0.00%)	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	**2 (50.00%)**	4	4.50 / 5 (90.00%)
The recruitment and retention of students.	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	1 (25.00%)	1 (25.00%)	4	3.75 / 5 (75.00%)

The responses represented in Table 9.6 shows that a total of four respondents participated. The figures indicate that 50% (2 out of 4) gave a high rating of'4' for the **'the culture of staff and students of the university'** while an additional 50% gave the highest rating of '5' for this item. Which suggest that all four respondents gave a high-highest rating. The same level of response was also given for **'the type of learning and teaching**

environment the university wishes to portray'. For options of 'The strategic vision of the University, The level of technology uptake of the University' and 'the recruitment and retention of students', 50% of respondents selected a medium rating of '3' while an additional 25% selected a high rating of '4' and a highest rating of '5' respectively. The figures suggest that a majority of respondents had selected a medium to highest rating for these items. **For 'the educational system and philosophy of the University'** a highest rating of '5' was selected by 50% of the respondents while an additional 25% had selected a medium and high rating of '3 and 4' thereby giving a positive rating of medium to highest. For this item as it were.

The response to what the main factors for the design of the teaching and learning spaces within their universities were are as shown in Table 9.7

Table 9.7 Results for Factors for the Design of Teaching and Learning Spaces

Factors for the design of teaching and Learning spaces.	Percentage	Responses
It is part of the strategic vision of the University	23.5	4
The users' requirement led to the changes	11.8	2
The availability of funding	17.6	3
The recent and ever changing technological advancement	17.6	3
The market competition for student retention	5.9	1
The desire for continued preservation and relevant in the academic world	0.0	0
Changes in the University's educational philosophy e.g. from tutor-led to student led studies	17.6	3
Other (Please Specify): 'the need for space to offer better services'	5.9	1

The response to the question indicates that all four respondents felt that the main factor for the design of learning spaces was because it was **'part of the strategic vision of their university'** this therefore supports the findings that most of the space design projects were institution led. Three out of the four also indicated other reasons to be **'the availability of funding, the recent and ever changing technology advancement as well as Changes in the University's educational philosophy e.g. from tutor-led to student led studies.'** while two out of the four respondents indicated that **'the users' requirement led to the changes'.** Only one respondent indicated that this could be due to **'The market competition for student retention and the other reason given by one respondent was 'the need for space to offer better services.'**

Response to users' preference of space types is as shown in Table 9.8

Table 9.8 Survey Results of HEI Executives' Perception of User's Preferences of Learning Spaces

Space Types/Rating scale	1	2	3	4	5	Responses	Average Score
General teaching and Learning spaces	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	1 (25.00%)	1 (25.00%)	4	3.75 / 5 (75.00%)
Vocational/ Specialised Learning spaces	0 (0.00%)	**3 (75.00%)**	1 (25.00%)	0 (0.00%)	0 (0.00%)	4	2.25 / 5 (45.00%)
Social/ Blended Learning Spaces for informal studies	0 (0.00%)	1 (25.00%)	0 (0.00%)	1 (25.00%)	**2 (50.00%)**	4	4.00 / 5 (80.00%)
Group teaching and Learning spaces	0 (0.00%)	0 (0.00%)	**3 (75.00%)**	0 (0.00%)	1 (25.00%)	4	3.50 / 5 (70.00%)
Virtual/Immersive learning environments	0 (0.00%)	1 (25.00%)	**2 (50.00%)**	1 (25.00%)	0 (0.00%)	4	3.00 / 5 (60.00%)
Library/ Learning Centres	0 (0.00%)	1 (25.00%)	**2 (50.00%)**	0 (0.00%)	1 (25.00%)	4	3.25 / 5 (65.00%)
Outdoor Learning spaces	0 (0.00%)	**2 (50.00%)**	1 (25.00%)	1 (25.00%)	0 (0.00%)	4	2.75 / 5 (55.00%)
						Total Average	**3.21 / 5 (64.29%)**

The results indicated that four respondents had participated out of five. The highest rating of '5' was selected by 50% (2 of the respondents) for the use of 'Social/ Blended Learning Spaces for informal studies' while 75% of respondents selected a medium rating of '3' for the use of 'Group teaching and Learning spaces'. 50% of the respondents also selected a medium rating of 3' for the use of 'Library/ Learning Centres, Virtual/Immersive learning environments and General teaching and Learning spaces' respectively. The rating of '2' which can be considered an indication of fair usage was selected by 75% of respondents for the use of 'Vocational/ Specialised Learning spaces' while 50% of respondents also selected a rating of '2' for the use of 'Outdoor Learning spaces'.

After the above content and thematic analysis of the first category of findings with respect to the space types and design factors within the institutions investigated, the next stage of analysis is that of the, use, and adoption of technology.

9.2.2 The Use and Adoption of Technology While Designing E-Learning Spaces

From the research results, the level of technology use and adoption has been categorised into low, medium and high. For the purpose of analysis, minimal use of technology within the design of a learning environment has been categorised as low if the use or incorporation into the design of the learning environment is negligible or non-existent. The use of basic technology and incorporation of these within the space design and facilities provided has been categorised as medium for example use of smartcards to allow access, provision of wireless access, use of light, motion or temperature sensors. While the purposeful use and built in design of technology to provide technology rich learning environments has been categorised as high such as the design of immersive and virtual studios, design of spaces that were purposely made to suit the needs of disabled learners e.g. to provide ease of access, furniture or appropriate space layout as well as technology as seen in some case studies represented in Table 9.9

Table 9.9 Level of Technology Usage from Case Studies Investigated.

Case studies	Level of technology use/ adoption	Nature of technology provided within learning spaces	Source of qualitative data
Case study 1- University of Wolverhampton	Medium – High	Incorporated as part of the space design of the new build.	documents, interview and case study report
Case study 2 University of Northumbria	Medium – High	Introduced after the space was designed as part of on-going renovations; incorporated as part of new build	documents, interview and case study report
Case study 3- University of Loughborough	Medium	Introduced during renovation works after the space was designed; New build was done as sustainable design	documents, interview and case study report
Case study 4- University of Essex	High	This was built into the new build university regeneration project from the onset	documents, interview and case study report
Case study 5- Leeds Metropolitan University	Medium – High	technology was incorporated after renovation works	documents, interview and case study report

9.2.3 Discussion

From the case study evidence collated, the level of technology use, adaptation and uptake in the e-learning spaces of the respective universities investigated was considered to fall within the medium to high category. This categorisation was due to the nature of technology and facilities provided which ranges from ‘open access to wireless IT up to provision of Virtual Environment i.e. specialist teaching and learning areas, technology supported social areas that encourages inter-disciplinary learning and inclusive design considerations.

For example case study 2-University of Northumbria, technology use was seen to be at a medium to high level as it were. This categorisation was due to the purposeful design and development of 'The new Virtual Environment' which aimed at helping with the integration of emerging Virtual Reality (VR) technologies in the School; in addition to the provision of basic technology within the social learning spaces such as wireless access, facilities and equipment. Details of the high level of technology provided within these spaces was included in the case study report albeit it was done as part of ongoing renovation works and therefore adapted after the initial structure had been built.

The same level of medium to high technology usage was evident in Case study 4-University of Essex, where the new build offered high level technology, enhanced learning facilities such as the 'i-lab' in addition to the basic technology provided i.e. wireless access, interactive studios, classroom fitted with white boards, projectors, printers, lifts and hallways fitted with interactive technology to facilitate ease of access and communication etc.

However unlike the situation in case study 2-University of Northumbria, where the technology was incorporated as part of on-going renovation works, the technology in this case was part of the new build from the onset and this allowed the design cater for future use and expansion which was indeed a point worth noting as it exemplified **'the design of future spaces and how we get there' as well as the design and incorporation of flexible, adaptable multifunctional spaces; which can be considered a best practice example as it were.**

The situation in case study 3- University of Loughborough was such that the technology use and uptake was as a result of the need identified which led to the refurbishment, renovation works whereby the spaces became upgraded to meet the demand. The level of technology provided were basically 'breakout rooms fitted with white boards, flip charts, sockets, power outlets, traditional data projectors, visualizers, foldable display boards, built in storage areas, video editing machine, and lighting control; thus it was categorised as medium. Also the new build developed was purposefully designed with 'the ethos of the design of the new build project being sustainability' this was incorporated into the design by the lighting being set to provide an ambient light source. Also provision for air handling (i.e. recirculation) within the building was made as well as controlled heating and humidity consumption in all meeting rooms. Furthermore, the walls were painted with magnetic paint-kidi care to reduce maintenance costs such that the use of blue tack on walls was not necessary. As was stated in the case study report, 'the building was thought to meet up all the specifications for glazing regulations, thermal qualities were standard, floors are thick while the mesh in front of the building provided solar power for the new build'. **These technology features can be considered good practice examples as well as it led to some remarkable benefits.**

The response obtained from the survey also supports the findings on technology use and uptake within the HEIs investigated, for example, in the responses to users' survey Q 18 which aimed to investigate the users' perception of the technological efficiency of their teaching and learning environment:-

Question:- The space design of the teaching and learning environment is technologically efficient because?

Majority of the respondents 32.4% (15 respondents) felt that the space was technologically efficient because 'the teaching and learning spaces were adapted into a technology supported teaching and learning environment', 19.6 % (10 people) of respondents felt that the efficiency of the technology within the spaces were due to 'the spaces being upgraded with recent cutting edge technology features. Also 19.6 %(10 people) indicated that the efficiency was 'based on the spaces being initially designed as a technology focused environment'. Some 15.7%(8 people) indicated that the efficiency was due to fact that **'the technology and equipment determined the space design of the teaching and learning environment'** while a few of the respondents 11.8% - (6people) indicated that the efficiency was because **'the users determine the space design and type of technology used within the teaching and learning environment'.** (See Table 9.10)

Table 9.10 Users' Response to Efficiency of Technology Usage

Options a-f reasons for efficiency of technology usage.	**Percentage**	**Responses**
a) The teaching and learning spaces were initially designed as a technology focused environment	19.6	10
b) The teaching and learning spaces were adapted into a technology supported teaching and learning environment	29.4	15
c) The teaching and learning spaces were upgrade with recent cutting edge technology features	19.6	10
d) The technology and equipment determined the space design of the teaching and learning environment	15.7	8
e) The users determine the space design and type of technology used within the teaching and learning environment	11.8	6
f) Other (Please Specify):	3.9	2

This view by 11.8% of the respondents also concurred with the response to question 17 of the users' survey below.

The response to weather users' opinion was sought about the design of the teaching and learning environment provided either during the design process or during the construction stage is as shown in table 9.11

Table 9.11 Response to Users' Involvement in Design Process

Answer	**Percentage**	**Response**
Yes	13.8%	4
No	86.2%	25
Total responses:	100%	**29**

The response obtained as tabulated above indicated that majority of the respondents' i.e. 86.2% (25 people) had not been involved in the design process or construction stage. However, 13.8% (4 people) indicated that they had been involved.

This goes to show that users are seldom involved in process of delivery of the TSL spaces provided. And this also underpins some of the other response which were as follows **'it is not technologically efficient'**, (no reason for this opinion was given by the respondent); another respondent's comment was **'joined the university after the design'**

9.2.4 Analyses of the Availability/ Accessibility of Technology

Overall, from the research findings, it was clear that the availability and accessibility of technology within e-learning spaces investigated was adequate in the respective HEIs. All the case studies seen had varying levels of technology usage and also various levels of availability and access to the users'. Also the benefits and impact on users were thought to be positive, results from some case studies in relation to this are discussed below for example:-

CASE STUDY 2- University of Northumbria: Availability/Accessibility of Technology

The Virtual Environment was PC-based and had two Christie digital DS 300 lumen projectors and a large VR screen and software to support usage. The facility could seat up to 20 people; a computer area at the rear of the facility had six work stations for student project / development work. The system installed was a Stereo Works DPL passive projection system that was connected to the projection system.

While the Student Hub had wireless access, and provision of a laptop loaning system, managed by two staff.

-The impact of Technology on the Users'/Benefits

The responses given were as follows:-

-The Virtual Environment was used by staff and students for design exploration and presentations. The system enabled interaction with three-dimensional models of buildings, sites and urban spaces and offers the experience of 'being immersed' in a simulated environment.

-**As recent developments in computer hardware and software were challenging the premise that VR was cost prohibitive and difficult to implement and maintain. The School had invested in a passive stereo projection-based system. Inexpensive polarized glasses enabled viewing of 3D stereo images by groups of up to twenty people. Students began by building models in 3ds Max and then exporting them into VR software. The large screen allowed students to view their designs from multiple viewpoints and to navigate through space in real time.**

- The Virtual Environment had benefits that were quantifiable; there had been increased consulting and marketing benefits. Discussions were on-going in relation to

city modelling. The School was now experiencing the benefits of a cheaper technology than was available five years ago. Upgrading the learning experience of students was the main focus of the project. They had been able to meet the needs of users and now other benefits were emerging.

- **"The facility will enable the exploration of possible benefits of VR across a wide range of built environment projects. The psychology of building spaces, visual environmental impact assessment studies and urban analysis are some of the applications of VR to be developed in the future"** (Margaret Horne- interview).

CASE STUDY 3- University of Loughborough: - <u>Availability and Accessibility of Technology</u>

- **Breakout rooms** had been fitted with white boards, flip charts, sockets, power outlets, traditional data projectors, visualizers, foldable display boards, built in storage areas, video editing machine, lighting control.

- **The foyer/exhibition area** had been fitted with LCD display screens and an informal sitting arrangement for up to 18 people; a drop in Mac & PC bar, wireless internet.

- **Breakout rooms & design studio: -** IT and relevant technology had been provided. These were in the form of AV recording equipment, induction loop, networked lectern with tablet pc, networked PC, networked printers/scanners/copiers; interactive white boards, active slates, video cameras, wireless data projectors, 3D wireless keyboards and gyro-mouse/pointer, flipcharts, wireless internet connection. Students and academic staff could book rooms by themselves through the same process. Equipments such as laptops were available for loan by students.

The student resources room:- This had been equipped with stilt cameras, 500Giga portable external hard drives, digital voice recorder, and video iPod for podcasting trials, networked A1 printer, plotter, scanner/copiers, guillotine, binders, A3 laminator, prs voting system, video cameras and tripod, tablet PC/laptops, Bluetooth graphic tablets,

<u>Impact of Technology on Users and Benefits:</u> - findings showed that there had been indication that the bookings were going up every semester. 2 years after the eng CELT building was finished.

- There was an increase in the diversity of room usage

- The learning and teaching spaces were being pressured to open earlier and increase time allocated for usage, from 8am - 8pm.

- Some unplanned benefits had also arisen from the new build and facilities provided. Marketing the facility helped raise the profile of engCELT in the University and Industry.

CASE STUDY 4- University of Essex: - <u>Availability and Accessibility of Technology</u>

- The technology was built into the design from the onset.

- IT facility and equipment were new and high tech; linked to the university network for students to gain access to anywhere within the building, 10 full AV rooms with networked AV computers and Symposium annotation screens, 3 Smart AV features with simple AV system installed, open study areas are fitted with wireless access, modern lecture rooms fitted with latest technology such as AV equipment, automated display screens, custom made lecterns, lighting control etc. as well as digital media recording and services facilities & equipment for supporting learners with disability on campuses

- The new build affords learners the exiting experience of a new approach to teaching and learning in a creative, high tech, user friendly environment. New courses, new facilities, dynamic culture, on-going flexible change process had been combined to give learners a unique experience

- The Business incubation units were an innovative approach for upcoming entrepreneurs' it also provided a first-hand experience for the students of the Business school

- The Dental Clinic facilities had standard equipment for hands on training as well as free health services for students.

- The benefits of having access to the 'i-Lab' had had such an impact at the University such that it invested in a second lab located at one of its other campus.

From the above analysis, it therefore obtains that the technology efficiency of e-learning spaces will also have an impact on the users and this in turn determines their perceived benefits of having technology incorporated within the bespoke space design of their learning environments. This is supported by the response to an interview question in this regard:-

Case study 4- The interviewee was asked a question on **Design outcomes/ Measurable outcomes e.g. increase in recruitment trend, better user spaces, and better learning outcomes?**

Response given-

- **The building won an award for regeneration and sustainable development.**
- **They had a very realistic budget and worked within it.**
- **12,300m^2 space was achieved. Everything was developed from scratch.**
- **The benefits of having access to the 'i-Lab' has had such an impact at the University of Essex that it has invested in a second lab located at its Colchester campus.**

Question on lessons learnt. "If you knew what you know now, what would you have done differently"?

Response given

-'From a project management point of view, the University reacted to an opportunity that involved a high risk approach. It was successful in managing the risks. In the ideal world the project cost & brief would have been determined, but in this case things were done differently'.

- 'When budgets are done for this type of project, flexibility has to be a major consideration. The learning environment can be described as effective and efficient'

In addition to the above, just to recapitulate what was reviewed in literature (Chapter 5) which has been seen to be true in the above data analysis done is; the report by Watson, et-al claimed that *'good design and effective management were vital to the success of projects (either new-build or refurbishment)'.* The report noted that *'much was at stake for directors of estates, project managers, and academic and library staff embarking on a large capital project'.* (HEFCE, 2005) *'Because such projects had the ability to influence the future direction of learning and teaching in an institution'*

The report claimed that *'frequently, the potential for technology was misunderstood',* and that this led to ***'designs that reflect patterns of usage from a pre-digital age, or***

encountered difficulties in practice. Furthermore it stated that *'JISC material had been assisting to discover a 'synergy' between ambitions for 'innovative 21st*-century learning and teaching and physical space designs that could motivate learners and teachers and function effectively.'*

The report reiterated also that similar research by JISC into the *'learner's perspective on e-learning' indicated a 'widespread use of personal technologies on as well as off campus and a growing requirement for spaces that facilitate collaborative and social learning'.* The report asserted that this finding was *'an indication of how learning spaces might evolve during the next decade',*(with respect to the future of learning spaces in Higher Education). In addition, it stated that *'JISC studies showed how learners were seeking greater control over the technologies they use', 'blending informal and institutional technologies in ways that support their individual needs'.*

9.3 ANALYSIS OF RESULTS BASED ON THE ELSD RESEARCH FOCUS

This is the third criteria for analysis as explained in section 9.1. From the onset of this research, some wider research focus were identified and discussed in the chapter one.

The following section presents the analysis of research findings and discussions with respect to the ELSD research focus.

I- Impact on facilities and design

II-The design of future spaces

III-The impact of blended learning on the design of spaces

IV- Designing for the learn anytime, anywhere paradigm

V- Security issues of design

VI- Levels of design risk in an e-learning infrastructure and also

VII- Inclusive design/future direction

From the results obtained, components of the ELSD Research Focus were seen to be significant as the feedback from the pilot studies and forums as well as the case studies and questionnaire surveys reflect this. The responses to questions 11-16 of the users' survey was thought to have satisfactorily dealt with these aspects and were therefore presented hereunder in tables 9.12- 9.14

Table 9.12 Results for Functionality, Aesthetic Quality and Innovative Use of Space

Design Parameters	1 very good	2 fair	3 satisfactory	4 poor	Responses	Average Score
Functionality	**12 (41.38%)**	11 (37.93%)	6 (20.69%)	0 (0.00%)	29	1.79 / 4 (44.75%)
Aesthetic quality	5 (17.24%)	**14 (48.28%)**	7 (24.14%)	3 (10.34%)	29	2.28 / 4 (57.00%)
Innovative use of space	**10 (34.48%)**	9 (31.03%)	8 (27.59%)	2 (6.90%)	29	2.07 / 4 (51.75%)

The response as shown above indicates that 41.38% (12 people) considered that the **functionality was very good option** '1' an additional 37.93% (11 people) felt that it was fair, '2' while 20.69% (6 people) felt that it was satisfactory. It can be seen that **all 29 respondents considered the functionality to be satisfactory, fair or very good.** No one felt that it was poor.

The result for **the aesthetic quality** showed that 48.28% (14 people) thought it was fair. It can be seen that **the greater number of 26 respondents said the aesthetic quality was satisfactory, fair or very good while a small number felt it was poor**.

On the innovative use of space, the results obtained showed that 34.48% (10 people) felt it was very good and **the greater number, 27 respondents said it was satisfactory, fair or very good while a minority of respondents felt it was poor.**

This implies that users felt the **functionality** of their e-learning space was very good; fair or satisfactory.

This implies that majority of users felt that the **aesthetic quality** of their e-learning space was fair, satisfactory, and very good while 10.34% thought that it was poor.

This implies that users felt **the innovative use of space to be very good**, fair and satisfactory more than the minority 6.90% who indicated that it was poor.

Thus from the responses it can be inferred that there was a positive impact of space

design and facilities on the users learning outcome.

Response to which space design solutions effectively supports teaching and learning requirement within the school is as shown in Table 9.12.

Table 9.13 Effectiveness of Space Design Solutions' in Supporting Users' Teaching and Learning Requirement

Questions 12	**Percentage**	**Responses**
12a) Open space plan arrangement i.e. no walls	7.5	5
12b) Enclosed space plans (i.e. with walls or glass partitioned areas)	22.4	15
12c) Flexible furniture arrangement to allow for multipurpose use	23.9	16
12d) Enclosed spaces without glass partitioned areas preferably opaque walls	7.5	5
12e) Spaces fitted with good lightening, ventilation and acoustics to absorb sound during collaborative learning	31.3	21
12f) Fixed furniture arrangement to allow for formal teaching and learning	7.5	5
12g) None of the above (e.g. I study at home)	0.0	0
Other	0.0	0

the mode for the above distribution was 21 respondents as the results obtained above indicates that a greater number 31.3% (21 people) of 29 respondents selected option 12e- '**Spaces fitted with good lightening, ventilation and acoustics to absorb sound during collaborative learning'**. The nearest figures to this were 23. 9% (16 people) of the 29 respondents who selected option 12c **–'Flexible furniture arrangement to allow for multipurpose use'**; followed closely by 22.4% (15 people) who selected option 12b- **'Enclosed space plans (walls and glass partitioned areas)'** as shown in options 12d and 12f, respectively; **'enclosed spaces with opaque walls',** and **'use of fixed furniture for formal teaching and learning'.**

The response therefore implies that some basic elements of architectural design within learning spaces such as **ventilation, lighting, acoustics, flexible furniture arrangement, multipurpose use of space and space planning** helped to define the users' perception of a well-designed e-learning space. This is further underpinned by the responses to questions on the Impact of Space Design on Teaching and Learning in the users' survey (Q13- Q14) analysed hereunder.

The response to weather users' felt the space design of the teaching and learning environment had improved their teaching and learning experience:

Implied that majority of respondents (a total of 25 people) agree that the teaching and learning environment has improved their learning experience. However a small number, 13.79% (4 people) indicated that they disagree.

The question on whether **the architectural design elements of the teaching and learning space could enhance or impair the users' overall learning or teaching experience; while considering** some design elements which were seen as important to the effective delivery of space design that were investigated also corroborates the former, the response given were as shown in Table 9.14

The results displayed in the table 9.14 were presented in chapter seven the implications are as follows :-

a) Majority of respondents felt that the design and location of the stairs and lift was ok while a minority disagreed

b) For the acoustics-sound levels, a total of 23 out of 29 people indicated medium to highest rating

c) For the furniture type and arrangement a total of 26 out of 29 people indicated medium to highest rating.

d) For the Space design and layout a total of 22 out of 29 people indicated a medium to highest rating

e) For the location of all fittings and services, a total of 23 out of 29 people gave medium to highest rating

f) For the circulation design, a total of 23 out of 29 people selected the medium to highest rating

g)For the ventilation design, a total of 24 out of 29 people selected the medium to highest rating

h) For the lighting levels, a total of 25 out of 29 people selected medium to high rating.

Table 9.14 Response to Factors that Have Enabled Teaching and Learning.

Questions /rating scale	**1**	**2**	**3**	**4**	**5**	**Resp.**	**Average Score**
14a) The location and design of the stairs and lifts	7 (24.14%)	5 (17.24%)	**12 (41.38%)**	3 (10.34%)	2 (6.90%)	29	2.59 / 5 (51.80%)
14b) The acoustics (Sound/noise control levels)	3 (10.34%)	3 (10.34%)	**13 (44.83%)**	5 (17.24%)	5 (17.24%)	29	3.21 / 5 (64.20%)
14c) The furniture type and their arrangement	2 (6.90%)	1 (3.45%)	**13 (44.83%)**	8 (27.59%)	5 (17.24%)	29	3.45 / 5 (69.00%)
14d) The space design and layout (flexible, adaptable & multifunctional spaces)	3 (10.34%)	4 (13.79%)	**8 (27.59%)**	7 (24.14%)	7 (24.14%)	29	3.38 / 5 (67.60%)
14e) The location of all fittings & services e.g., IT, Toilets, Stairs, Lifts, Vending Machine etc.	3 (10.34%)	3 (10.34%	**13 44.83%**	5 (17.24%)	5 17.24%	29	3.21 / 5 (64.20%)
14f) Circulation design (how people access the building and move about)	4 (13.79%)	2 (6.90%)	6 (20.69%)	**9 31.03%**	8 27.59%	29	3.52 / 5 (70.40%)
14g) The ventilation design	2 (6.90%)	3 10.34%	**13 44.83%**	9 (31.03%)	2 (6.90%)	29	3.21 / 5 (64.20%)
14h) The lighting levels natural/artificial	2 (6.90%)	2 (6.90%)	8 (27.59%)	**10 34.48%**	7 24.14%	29	3.62 / 5 (72.40%)

The response to weather users felt that the space design of the teaching and learning environment was suitable for their requirements is as shown in Table 9.15.

Table 9.15 Response to Suitability of Space Design to Teaching and Learning Requirement

1	2	3	4	Responses	Average Score
very suitable	**fairly suitable**	**unsuitable**	**very unsuitable**		
12 (41.38%)	**13 (44.83%)**	4 (13.79%)	0 (0.00%)	29	1.72 / 4 (43.00%)

Table 9.15 showed that 44.83% (13 people) felt that it was fairly suitable while an additional 41.38 %(12 people) felt it was very suitable. This can be implied to mean that majority of respondents perceived that their environment was suitable for their requirements as indicated by 25 out of 29 people compared to the 13.79% (4 people) who disagreed.

For the **effective incorporation of elements of inclusive design considerations in the design of e-learning spaces or the lack of it, The descriptive response was presented in chapter seven** as separate charts during the presentation of survey results. The areas of inclusive design investigated were:

a) The effectiveness of the provision of wide corridors and doors for wheel chair users in their HEI.

b) The effectiveness of ‘ramps for ease of access throughout the facility’

c) The effectiveness of automatic doors with self-closing and opening devices

d) The provision of proper signage combining both text, colours, lighting and symbols for easy direction,

e) The use of non-slip floor finishes preventing slips and falls

f) The provision of handrails, stair lifts (where required) and guard rails on stairs.

g) The provision of adequate lighting along corridors and spaces

h) The provision of ‘outdoor areas for relaxation/informal activities

i) The provision of ‘disabled users’ fittings and facilities

Table 9.16 Results for Inclusive design elements

Questions/rating scale	1	2	3	4	5	Responses	Average Score
a) Wide corridors and doors for wheel chair users	0 (0.00%)	1 (3.45%)	**13 (44.83%)**	7 (24.14%)	8 (27.59%)	29	3.76 / 5 (75.20%)
b) Ramps for ease of access throughout the facility	2 (6.90%)	1 (3.45%)	10 (34.48%)	**11 (37.93%)**	5 (17.24%)	29	3.55 / 5 (71.00%)
c) Automatic doors with self closing and opening devices	1 (3.45%)	2 (6.90%)	**15 (51.72%)**	4 (13.79%)	7 (24.14%)	29	3.48 / 5 (69.60%)
d) Proper signage combining both text, colours, lighting and symbols for easy directions	2 (6.90%)	1 (3.45%)	**10 (34.48%)**	9 (31.03%)	7 (24.14%)	29	3.62 / 5 (72.40%)
e) Use of non slip floor finishes to prevent slips and falls	1 (3.45%)	3 (10.34%)	**10 (34.48%)**	6 (20.69%)	9 (31.03%)	29	3.66 / 5 (73.20%)
Provision of hand rails, stair lifts (where required) and guard rails on stairs	0 (0.00%)	3 (10.34%)	**11 (37.93%)**	7 (24.14%)	8 (27.59%)	29	3.69 / 5 (73.80%)
g) Adequate lighting along corridors and spaces	0 (0.00%)	0 (0.00%)	**11 (37.93%)**	7 (24.14%)	**11 (37.93%)**	29	4.00 / 5 (80.00%)
h) Outdoor areas for relaxation/informal activities	0 (0.00%)	7 (24.14%)	7 (24.14%)	**8 (27.59%)**	7 (24.14%)	29	3.52 / 5 (70.40%)
i) Disabled users fittings and facilities such as toilets, grab rails, adjustable furniture and IT equipment	0 (0.00%)	3 (10.34%)	8 (27.59%)	**11 (37.93%)**	7 (24.14%)	29	3.76 / 5 (75.20%)

Implication of Findings on Inclusive Design

The question and responses obtained from users in Q16 will go a long way in providing answers to the issues of inclusive design within an e-learning space. Also the findings align with principles for inclusive design as stated in similar work. These were set out by 'a working group of architects, product designers, engineers and environmental design researchers' who worked together to launch the 'Principles of Universal Design' intended to provide guidance to a huge number of design professions including 'environments, products, and communications' this was commissioned by 'The Centre for Universal Design' a 'national research, information, and technical assistance centre' which was set up to 'evaluate, develop, and promote universal design in housing, public and commercial facilities, and related products' (CUD, 2008).

It was stated that these 'seven principles' may be used for 'evaluating existing designs, guide the design process and educate both designers and consumers about the characteristics of more usable products and environments.'

PRINCIPLE ONE: Equitable Use - The design is useful and marketable to people with diverse abilities.

PRINCIPLE TWO: Flexibility in Use- The design accommodates a wide range of individual preferences and abilities.

PRINCIPLE THREE: Simple and Intuitive Use- Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

PRINCIPLE FOUR: Perceptible Information-The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

PRINCIPLE FIVE: Tolerance for Error- The design minimizes hazards and the adverse consequences of accidental or unintended actions.

PRINCIPLE SIX: Low Physical Effort- The design can be used efficiently and comfortably and with a minimum of fatigue.

PRINCIPLE SEVEN: Size and Space for Approach and Use- Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

9.3.1 Discussion

In addition to the above responses from the survey, some responses obtained from forum participants and interviewees with respect to the above issues are discussed and analysed hereunder:-

Forum participants: - It was thought that **the impact of e-learning on facilities and space design was limited by the mobility of the equipment' and 'design of furniture and facilities within the space**' the impact was also said to be limited by '**the lack of adequate training for end users of facilities'**. It was argued that often the creation of **'useless spaces' occurred'**; it was an expectation that **'functionality** was what space were for'; for some **the concept of open planning** was a preference while for others the constraints of **'noise, lack of concentration and security was a concern**. Participants agreed that **'information technology could enable space or disable space'.**

- It was expressed that the **'flexibility of furniture/ design** and procurement of furniture in e-learning spaces' also **had an impact on space design and learning outcomes** and that there were concerns about '**the type of furniture designs** used within learning environments as well as **'the need for assistance in procuring and designing better furniture'.**

-**The impact of blended learning on the design of learning environments** was thought to be **related to 'the development and construction strategy of the University'.**

- It was stated that in the process of **'redesigning a building**, 'the problems **with the existing/ old structure' ought to be investigated** before commencement of the project.

- It was opined that in **designing for the-learn anytime, anywhere paradigm, 'there was an opportunity to learn and get ideas'** as well as **the need to provide 'guidance for HEI who were about to embark on some new build projects'**. It was thought that this will help them to **'hopefully avoid mistakes'**.

- It was also stated that **'the design of e-learning spaces should not only incorporate limitless flexibility (i.e. adaptable, adjustable and multifunctional spaces)** but should be **personalised and customised; combining functionality** and should **be inspirational** and **focus on how to use the learning environment to achieve better performance'**.

- It was thought that there was **‘definitely a connection between the impact of good design of learning environments on the users within the University’ and the university’s ‘strategy for achieving a student-focused and flexible learning environment mixed with blended learning**’ as well as the ‘types of e-learning construction projects within HEI’s’

- The **future of e-learning spaces and how we get there**; in future HEI buildings would **incorporate mixed-use spaces, amidst the learning environment.**

- It was observed that consideration of **‘the security issues of e-learning and e-learning space design, as well as ‘the levels of design risk in an e-learning infrastructure’ was required. As there ‘were huge risk and challenges posed by designing for e-learning environments.**’

- The HEFCE key requirements from the projects they funded were; **‘ability to handle the responsibility of providing strategy that achieves student focused buildings; utilisation of HEFCE guidance on space management and sustainability and the need to achieve collaboration between teaching and learning’.**

The interview response:-

<u>On issues of design risk</u> – An interviewee’s response was that ‘from a project management point of view, the University reacted to an opportunity that involved **a high risk approach**. It was successful in managing the risks. In the ideal world the project cost & brief would have been determined, but in this case things were done differently’.

The same interviewee also stated that- ‘When budgets are done for this type of project (in this case a new build), **flexibility has to be a major consideration**. The learning environment can be described as effective and efficient’

<u>On issues of user involvement- </u>another interviewee stated that ‘often times, the **refurbishment works involved input from in-house estates and facilities staff. Major renovations were outsourced to consultant’;** the reason for this may be due to the thinking expressed by some interview participants. It was a general belief that ‘**collaboration or knowledge sharing between HEI was nonexistent**, with no information for benchmarking hence HEIs often relied on their in-house Estate and Development Staff to handle construction/design projects.

In another instance, case study 4- university of Essex to be precise, it was noted that: - **Meeting with stake holders and communicating regularly helped to revalidate user requirement.** Furthermore, users were allowed to redo the spaces to suit their activities.

This was also seen in case study 3 University of Loughborough, as the evidence gathered from the interviewee and site based analysis showed that the design outcome was mainly due to **a user led approach which allowed for collaboration, design flexibility, attention to users requirement, inclusive design solutions and the successful delivery** of what was considered a better e-learning environment.

However the overriding impression expressed by most of the interview participants was that-:

User involvement was often unwelcomed and as it were, most projects were` executed with little input from the space users. However, some form of interaction and feedback was in place as seen in most of the cases investigated.

On the issues of security- it was observed from data gathered and interview responses that while **some HEI depended on technology features** such as CCTV cameras, Access control swipe cards, **others depended on security personnel** while in addition to the above security measures, some **other HEIs also depended on their students** to protect the facility which had been provided for them.

In addition to the above categories of analysis, the data in the questionnaire survey which were **presented inform of Likert tables have been analysed by using frequency distribution. While those items that were in the form of Ordinal data have been analysed using median and mode**. These are discussed hereunder.

From the users' survey, the data collected were as follows: -

Q1) What user group do you belong to? (please tick as appropriate)

From the response obtained, it indicated that 55.17% (16 persons) of the survey respondents were students while 41.38% (12) were staff and 3.45% (1 person) was a consultant. A total of 29 responses were obtained. **Therefore the approximate ratio of student to staff respondents was 16:12 or 4:3.**

Q2) If you are a Staff, please what category do you belong to

Response showed that they were made up of 6 teaching staff, 2 administrative staff, 4 research staff. While 10 persons selected the N/A option which may imply that they were students. A further response obtained by 7 persons who selected the other option showed that; 1 was a management staff and 1person was a consultant while the remaining 5 were students. **Therefore, the ratio of teaching staff to administrative staff to research staff as shown by the figures was 7:2:4.**

Q3) How many years of experience do you have as a Staff? Please select n/a if you are not a Staff

One had less than two years while eleven respondents had over 2yrs. seventeen people indicated that this question was not applicable to them (it can be assumed that they were the students and consultant and management staff as indicated in question one.) **the mode for the above distribution were those respondents that were in the category of 2-5 years and 15-20 years' experience.**

Q4) If you are a Student, what is your mode of study? Please select n/a if you are not a student

The responses indicated that 20 people were fulltime students while 8 selected the N/A option (these could be assumed to be staff) while the other response from one person was "I am a lecturer." The results suggest that about four people were also staff members as well as students hence the increase in number from 16 students to 20 who indicated that they studied on the full time mode. Or it could be that the 4 people selected full time as the mode of teaching.

Q5) What is your age group?

The data obtained showed that none of the respondents was below 20 years; most were between ages 20-29 and 40-49. While two were between ages 50-59 and 1 person was 60years or above. This therefore suggests that most of the staff and students respondents were matured. **The highest frequency distribution of age groupings, were those within the 30-39 category as indicated by the 9 respondents.**

Q6) What is your field of specialty/study?

The results obtained for the question on the area/field of speciality of respondents. Those eleven respondents who selected other indicated that their specialities were i) Built

Environment, ii) Structural Engineering, iii) Construction, iv) Construction economics, v) Project Controls & Management, vi) CEM, vii) Engineering Education, viii) Construction Project Management (these can be assumed to be under the field of Engineering and the built environment). The others were ix) Technology support for learning, and x) Business information technology. This could be grouped under Computing and IT.

The results show that highest numbers of respondents **(mode for the distribution)** were from the sciences and in particular, the Engineering and Built Environment discipline. This may be due to the unwillingness of other users from other disciplines to participate.

Q7) What is your gender?

The ratio of male to female was 16:13 there were more male respondents than female. This could be due the observation made that the respondents were mainly from the sciences i.e. engineering and built environment discipline which is known to be more dominated by males.

Q8) Would you consider yourself as having any form of disability or medical condition requiring additional support?

The results obtained shows that 1 out of the 29 respondents was disabled that is a ratio of 1:28 as it were. Also the response from the five respondents who participated in the designers' survey showed that only one person was disabled with a ratio of 1:4.

Q9) Questions on the Use of E-Learning Facilities
Please grade in order of priority where (1) is the lowest and (5) is the highest
The teaching and learning facilities provided enables me to:-

The result of the priority rating of what the teaching and learning facilities enables users' to do within the e- learning environment indicated that 37.93% (11 people) rated participation in collaborative teaching and learning, as well as the ability to access online studying materials as '5' which is the highest priority; while 55.17% (16 people) rated the checking of e-mails and surfing the web highly as well which suggests that this was a priority to most participants compared to using the facilities for quiet study which was rated '3' by 37.93% (11 people) which is an average priority rating. Another activity rated high was the ability to conduct research work, analysis or experiments- 41.38% (12 people). The activity with the least score on the rating was the ability to carry out presentations which was rated '3, 4 and 5' by 31.03% (9people) respectively. While the participation in tutorials and training sessions was rated '3' by 31.03% (9 people) was also given an average priority rating.

These results showed that the **(mode for the statistical figures) majority of the users rated the surfing of web and checking e-mails as the highest priority within their learning environment.** This could be due to the need for social interaction that could be academic or non-academic. Also it could be that there is an increase in teaching and learning contents being uploaded and accessed via the web or e-mails by users as a result of the changing use and type of technology provided within the learning environment for example the 'Moodle'. The findings to support the above inference are however not included within the scope of this study and could be a future direction for research.

9.4 DEVELOPMENTS/ INFERENCES FROM THE ANALYSES.

9.4.1 Towards Developing Guidelines for Good Practice Design

Cardellino et al (2009) established a set of core principles of design quality which were grouped into**: fitness for purpose (or functionality), efficiency and sustainability, build quality, flexibility and adaptability, aesthetically pleasing, contextual fit, inspirational, accessibility, and safe and secure environments** these were successfully implemented in the BSF projects.

Similarly, after data analyses of feedback of interviews/survey responses obtained during the study, ten important guidelines were flagged up. Some aspects of these are similar to Cardellino et al.'s (2009) categorisation. The ten guidelines developed are listed below;

- 1) Avoid the creation of dead unusable spaces; -fitness for purpose/functionality
- 2) Involve user participation in design projects; - Inclusive design consideration
- 3) Incorporate vital architectural design elements; - Contextual fit, accessibility, build quality etc.
- 4) Provide the right space type, design and technology for the teaching and learning activity; - functionality/build impact
- 5) Open dialogue between HEI to encourage benchmarking and prevent avoidable errors; - Due diligence
- 6) Obtain proper guidance on furniture design, type, layout and procurement; - flexibility, efficiency & sustainability
- 7) Adopt a phased construction strategy; - Project strategy/deliverable
- 8) Design for physical security as well as security of software/data; -Providing safe and secure environment
- 9) Provide outdoor learning spaces, user defined spaces as well as multifunctional spaces. - Flexibility, Adaptability and future proofing.
- 10) Design motivational, inspirational and aesthetically pleasing environments- aesthetics, build-impact and user satisfaction

9.4.2 Towards The Development of A Novel Methodology/ Framework

A framework for the design of e-learning spaces in HEI campuses was developed on the basis of the results obtained (If we recall figure 9.2). The proposed how-to guide developed from the framework comprises of four stages. The first three main planning stages developed from the constructs used for analysis: which were- The Space Design; The Technology use/uptake and the E-learning research focus and the fourth an implementation stage with recommendations and design sketches. These are presented hereunder.

<u>STAGE 1 -ESTABLISH THE NEED FOR SPACE DESIGN-</u>

The following five steps have been developed as guidance towards achieving this first stage:-

I. Identify user requirement

II. Identify institutions' project strategy and source of funding

III. Identify required construction type- new build, renovation or refurbishment

IV. Identify suitable space type- e.g. multipurpose, open plan layout for blended /social learning

V. Identify the required technology to be incorporated within the design of the space

This stage involves a lot of planning and continuous dialogue between the representatives of the three groups identified in the study which are the Users' i.e. staff and students, the Stakeholders i.e. the financiers and HEI Executives and the Designers/ e-learning space design champions also it is expected that the flow of information ought to be flexible such that if the for example a users' requirement cannot be accommodated within the Institutions' project strategy, it can be reviewed and vice-versa and it is represented in figure 9.3 below

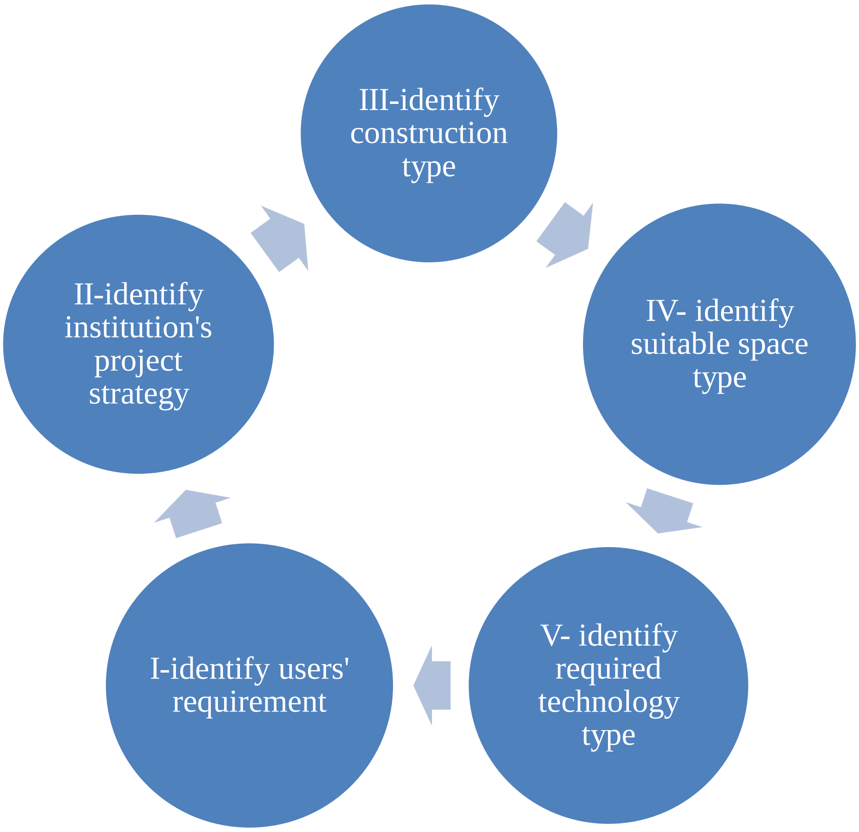


Figure 9.3 The Concept of Stage 1-How to Establish the Need for Space Design

STAGE 2- ESTABLISH THE TECHNOLOGY TYPE REQUIRED

In order to establish the technology type required, the following steps have been developed

I. Identify genuine Users' technology (tech) preferences and requirement

II. Carry out a technology need analysis

III. Identify Institutions project strategy, budget and funding sources for procurement

IV. Identify construction type and suitable parameter for proposed technology

V. Flexibility in choice of technology equipment and installations to allow for changes such as future technology upgrade, downgrade or replacements

This is also a planning stage that should involve the three groups of participants mentioned in stage 1 above. It is suggested that this planning process be carried out simultaneously where possible to allow for proper structuring and avoidance of afterthought IT installations that affect the level of functionality, aesthetic quality and build impact of the space and it is represented graphically in figure 9.4

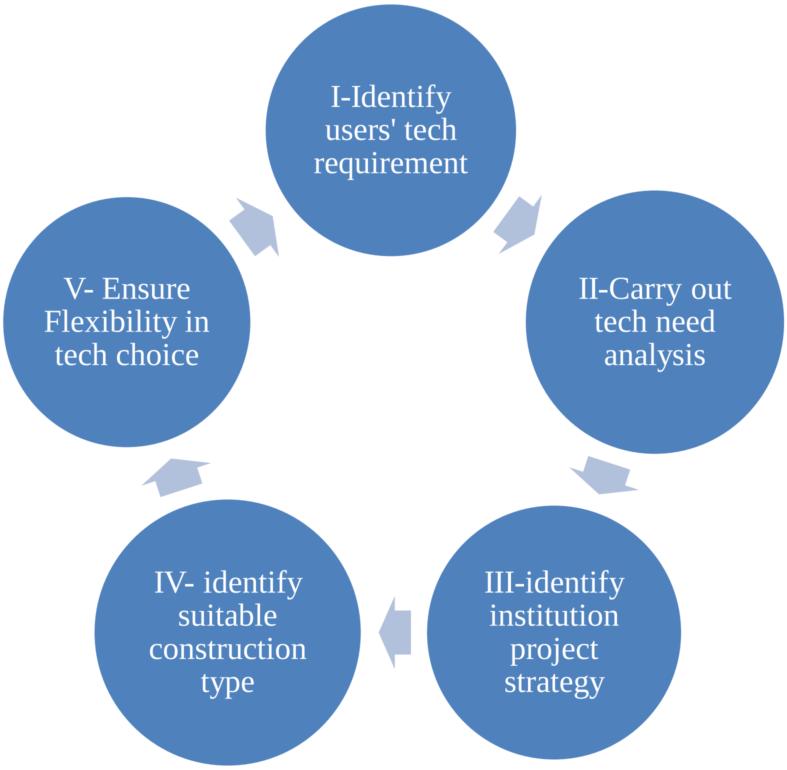


Figure 9.4 The Concept of Stage 2- Establish the Technology Type Required

STAGE 3 – IDENTIFY E-LEARNING SPACE DESIGN (ELSD) FOCUS

This stage of the framework has been developed based on the Research Focus of the study and it comprises of the research focus and guidance on how it can be adapted into the How to guide from the answers to the research questions as well as examples of where these have been successfully implemented within the context of the study. This is summarised in Table 9.17 below

Table 9.17- Stage 3 How to Identify ELSD Research Focus- The Proposed 'How to

Guide'

S/no	ELSD Research Focus	Adaptation /development of how to guide from research questions	Example of design implementation
1	The impact of e-learning on facilities and design	i) How has technology advancement affected the design or provision of e-learning environments and facilities in the HEI?	**Case study 2- University of Northumbria**
2	The design of future spaces and how we get there	ii) How can user requirement and input affect the future design of e-learning environments (flexibility, multifunction of spaces and material use)?	**Case study 1 & 4- University of Wolverhampton & University of Essex**
3	The impact of blended learning on the design of spaces	iii) How will blended learning affect the future design of social, teaching and vocational learning environment?	**Case study 1**
4	Designing for the learn anytime, anywhere paradigm	iv) How can we design for the learn anytime anywhere paradigm	**Case study 3 University of Loughborough**
5	The security issues of e-learning and e-learning space design	v) How can space design promote security of facilities in an e-learning environment?	**Case study 2, 3 & 4**
6	The levels of design risk in an e-learning infrastructure	vi) How can levels of design risk in an e-learning infrastructure be reduced?	**Case study 4 & 5**
7	Inclusive design and its future direction	vii) How can inclusive design be incorporated in future e-learning spaces?	**Case study 2 &4**

In this third stage of the frame work, the project team or participants involved in the planning would be required to look at the ELSD focus that best describes the proposed space design, answer the related question This will ensure that there is clarity of focus for the project being undertaken Once this has been understood, then they can look at the case study example which will be available via an online link to the ELSD website so as to give them a first-hand preview of how it was achieved as well as provide the needed guidance and motivation.

STAGE 4- INTERPRETE FINDINGS INTO SPACE DESIGN SOLUTIONS

This stage will involve the interpretation of the findings collated from the preceding stages into space design solutions by the Architect, Designer or E-Learning Space Design Visionary/Champion. The possibility of initial sketches being produced at the preceding stages can help build up a catalogue of What, Why, Where and How with respect to users requirement vs. institution's strategy for project delivery as well as the changes that occurred during the interactive process of dialogue, planning and exchange of ideas by all project participants.

The above stages explained goes towards achieving Objective 4- To develop a framework, evaluate and adapt into a 'how to guide'.

9.4.3 Evaluation of the Framework

An evaluation of the framework was done before it was adapted into an e-learning space design 'how-to-guide' in line with Objective 5. This evaluation also provided validation on the reliability of the findings as they are meant to serve as reliable benchmark/resource point and guidance for HEIs that wish to undertake future construction projects of e-learning spaces.

The evaluation process

The process for evaluation of the framework ideally would have been done by inviting different project participants on a real life project to evaluate and test run the frame work in order to determine its adaptability and efficiency, as well as to provide first-hand opinion on how to refine and amend the proposed framework where necessary. Due to time constraint, this was however not possible. Therefore, in order to circumvent this, expert opinion was used to validate the framework.

In this regard, Executive staff members and Consultants outside the supervisory team were invited to carry out an independent evaluation of the framework. This involved presentation of the research work by the researcher followed by the evaluation of the work. This first process was for the duration of 2hours in a face to face meeting. After which the comments were documented.

Other Executive staff members from MIT, USA and Ajman University in UAE were contacted for the evaluation via e-mail and telephone.

Finally 3 Senior University staff (2 academic and 1 non-academic executive staff) as well as and 2 users were contacted via questionnaire for evaluation of the following aspects of the research:-

The data gathering techniques; the research design methodology and approach as well as the field work and the presentation of results and analyses that led up to the development of the framework. This was in order to obtain honest opinion about the work as well as to compare the feedback from all evaluators for validity.

<u>Summary of evaluation received</u>

Some of the comments received were summarised as follows:

The HEI Executive (Pro- Vice Chancellor and Executive Dean, Faculty of Environment and Technology) Observed that **with respect to the guidelines developed from the research- 'It was clear that the ten point guidelines were grilled out of the inferences, developments, rationales and multifaceted approach to analyses of the overlapping results thereby making the framework very adequate'.**

He also stated that **with respect to the 'How-to-guide' The illustrative interpretations as examples of options of space design solutions in addition to the four stages of the guide were considered to be 'a very relevant aspect of the research outcome as it afforded the reader an opportunity to see and understand how these guidelines can be adopted into practical design situations by HEIs'.**

Another observation made by a senior staff from a university was that **with respect to the research approach, methodology and field work, 'it was clear that the researcher carried out extensive work in order to produce credible results. This is the essence of research at this level'.**

While the senior consultant expressed the view that **'the research findings could be further developed for adoption in Industry'.**

An Executive of HEI commented that **with respect to the three constructs that emerged as components of the framework i.e. Space Design, Technology and the Research Focus**, it was understood that these and the users requirement would constantly have an impact on each other in the delivery of future proofed teaching and learning environments;

but the variables investigated within the parameters of the research focus (users requirement) could vary in future as such a further investigation of aspects not covered could thus be considered for future research.

9.4.4 Development of the ELSD 'How to guide'.

The development of the How-to-guide was achieved through the process of collating data obtained from content analysis, case study analysis and responses received from interviewees compared to the survey response.

The summary of the steps taken for the development of the proposed 'ELSD How-to-guide' is presented below

ELSD How to guide

Section one- Contains the 10 point ELSD Guidelines (as outlined in 9.4.1)

Section two- Contains the ELSD 3- part Frame work (as outlined in 9.4.2)

Section three- Contains the 7 point 'How to guide' (as outlined in table 9.17)

Section four- Contains design guidance for implementation and further reading/sources

The how to guide- Is a user friendly design guide comprising of illustrative interpretations of the use of the space design guidelines developed

The guide (adapted from table 9.3) has been developed based on the research findings and analyses done. It aims to provide guidance for designing future e-learning spaces in HEI while considering the answers to design questions within the context of the ELSD focus investigated. The detailed answers collated on the research questions have also been presented here under.

9.4.5 Discussion on Research Questions

The research questions that emerged from the study covered aspects of the research focus developed with respect to the design of future spaces, design risk and security issues, blended learning, inclusive design, etc. and these have been discussed hereunder.

Q1) how has technology advancement impacted the design or provision of e-learning environments and facilities in the HEI?

Answer- Suitably designed technology supported learning environments, with appropriate network and infrastructures are needed to be incorporated into a facility. Alongside this, the characteristic of **'design responsibility'** for the constituent parts of the infrastructure and the process through which these are incorporated into the design were seen to be important. It can therefore be concluded that **'if the design was suitable, it could sustain other benefits, for example the 'integrated business and learning processes' and 'intelligent' buildings.**

Application- From the research findings, Case study 1- is an example of where this has been achieved.

Relevance to the How to guide- it provides guidance on 'How to design intelligent buildings with functional spaces and suitable technology'

Q2) how can user requirement and input affect the future design of e-learning environments (flexibility, multifunction of spaces and material use)?

Answer- As the spaces are primarily designed to suit the requirement of the users **with the advance of technology it was now a possibility for the architect/designer to develop more adventurous solutions for e-learning space design**. It is thought that this will promote group studies, inclusive design, security of spaces and software and the use of supporting technologies resulting in flexible learning environment with fittings to meet individual needs. In addition, findings indicate that **within further and higher education there was evidence of significant changes in ways of working, teaching and learning, the main drivers being the availability of funding and use of new technologies**. it can be concluded that all these affect the design'

Application- from the research findings, Case study- 1 & 4 are examples of where this has been achieved

Relevance to how to guide- it provides guidance on 'How to design future spaces that are inspirational, adventurous & future proof'

Q3) how will blended learning affect the future design of the (social, teaching and vocational) learning environment.

Answer- From the research findings, it can therefore be concluded that the **future design would exhibit more of blended learning** which suggests that there would be more individuals studying within the same environment irrespective of its type (formal or informal space) such that the spaces may actually be occupied in various types of activities based on users' requirement and study patterns which are varied**; the successful implementation of this within the overall design of the learning environment, as well as the entire HEI campus is a desired solution.**

Application- from research findings, Case study 1, 2, 3 are examples of where this was achieved

Relevance to how to guide- it provides guidance on 'How to design a blended learning environment suitable for varied user patterns'

Q4) how can we design for the learn anytime anywhere paradigm

Answer- from findings on varied user learning patterns and styles, It can therefore be concluded that the design for the learn anytime, anywhere scenario would be achieved by the provision of suitable technologies combined within flexible spaces designed for varied learning patterns such that users at anytime, anywhere can study.

Application- from the research findings, Case study 3 is an example of where this was achieved

Relevance to the how to guide- it provides guidance on 'How to design for the learn anytime anywhere paradigm- flexible learning environment'

Q5) how can space design promote security of facilities in an e-learning environment
Answer- Findings showed that **security issues could refer to the physical security of the space and the facilities within the space, the information and data as well as the security of corporate information and data**. Therefore, the physical security issues could

be enhanced or hindered by the **design of open plan spaces and the avoidance of design traps such as "nooks and crannies"** as well as **the physical security features that could be constructed into the e-learning facilities**.

Based on the research findings, It can therefore be conclude that design can be used to promote the security of spaces and facilities by the use of open plan layout, avoidance of dead spaces, nooks and crannies as well as incorporation of security devices, access control, adequate lighting and security personnel.

Application- from the research findings, Case study, 2, 3 & 4 are examples of where this was achieved

Relevance to the how to guide- it provides guidance on 'How to design safe and secure learning environments'

Q6) how can levels of design risk in an e-learning infrastructure be reduced?

Answer- The users might find the spaces unsuitable for learning, or the delivering of learning; hence the need to provide design solutions **that reduces the risk of such unforeseeable eventualities** findings indicate that the onward growth of technology brings along additional design risks and therefore it was imperative that designs were sufficiently adaptable and flexible enough to accommodate the 'long-term sustainability of facilities in the light of technological change, which would help avoid expensive mistakes.

From research findings it can therefore be concluded that in order to reduce levels of design risk in e-learning space design, user participation, continuous dialogue between all parties as well as adoption of phased project delivery strategy be encouraged in order to avoid 'expensive obsolescence' and achieve 'long term sustainability'

Application- from research findings, case study 4 and 5 are examples of where this was achieved.

Relevance to the how to guide- it provides guidance on 'How to minimise design risk in the delivery of e-learning space design & infrastructure'- achieve long term sustainability

Q7) how can inclusive design be incorporated in future e-learning spaces?

Answer- Findings show that **'inclusive design leads to better-quality design solutions**

advantageous to all'. As indicated by the response to the survey.

The National Curriculum set out three main goals for inclusive learning traditions; **'to set adequate learning challenges; to respond to pupils diverse learning needs and to overcome potential barriers to learning and assessment for individuals and groups of pupils'** DfEE (2001).

Furthermore, the seven principles (CUD, 2008) also serves as a guide for inclusive design process as well as the 3 principles of inclusive design reviewed in chapter 2 where it was asserted that becoming more inclusive was a process and not an event in the light of the speed of technological uptake for teaching and learning'.

Furthermore, from the research it can be concluded that in order to achieve inclusive design within e-learning space design, inclusive design features ought to be incorporated within the overall space design, with detailed emphasis on the architectural design elements, furniture type, layout and technology provided. This ought to be done in a gradual interactive process that allows for trials and test running of every aspect of the overall space design and facilities within it.

Application- from research findings, Case study 2 is an example of where this has been achieved.

Relevance to the how to guide- it provides guidance on 'How to incorporate inclusive design in the delivery of e-learning space design in HEI'- in line with technology advancement and design efficiency.

It is the researcher's expectation that the ELSD how-to-guide developed can be presented in form of a user –led manual that will be available in print as well as online. Thereby achieving the secondary objectives as well as the research aim and objectives and enabling the dissemination of findings to every HEI and Individual as well as the Industry at Large.

9.5 THE IMPLICATION OF THE ELSD GUIDE &FRAME WORK.

The likely implication of a How to guide that addresses the issues of e-learning space design would be:-

-The provision of good practice guidance/ practical examples for the delivery of future spaces (see 3D visualisation examples produced)

-Reduction in avoidable errors in design projects

-Foster increase in communication between HEI community on space design issues

-Provision of a benchmark for those who wished to execute future projects

-Encourage participation of users in the design process, rather than exclusion

-Increased awareness of inclusive design requirements for space design in HEI

-Increase awareness of options for delivery of space design projects with regards to available funding, In-house/professional expertise, institutional strategy, perceived risks etc.

9.6 CHAPTER NINE SUMMARY

This chapter focused on the general analysis of results. The qualitative data were analysed by the case study method of analysis, content and thematic analysis.The data collated were analysed under the three important constructs that emerged i.e. space types, technology use and adoption and the ELSD research focus developed while taking into consideration the recommended procedures for the Mixed Methods research approach from similar research. Quantitative data, analyses were done through descriptive statistics procedure showing the percentage value, ratios, mean, median and mode of data for the reader to understand easily.

The discussions based on data analysis adequately proved the research hypotheses to be true. Answers to the research questions were also discussed. The data from different sources overlapped in some aspects due to the Mixed Methods research design used. This was not intended to be repetitive but it goes to establish the validity and reliability of findings through the varied data gathering technique, sources and respondents.

The development and inferences from the analysis were used to build up the good practice guidelines. An explanation on how the research outcome was developed into the ELSD frame work was presented. The 'How to guide' was developed from the entire process which led to achievement of the research aim.

The evaluation of the research (methodology, the findings, guidelines developed, the framework and its component constructs used for data analyses for developing the proposed 'How-to-guide) was a vital aspect of the research. This was carried out mainly through face to face interview, telephone and via questionnaire survey. Executive Staff, Senior Staff and Users (i.e. independent assessors/ evaluators) outside of the supervisory team were used for the evaluation. The summary of their feedback stated that 'with respect to the guidelines developed from the research- 'It was clear that the ten point guidelines were grilled out of the inferences, developments, rationales and multifaceted approach to analyses of the overlapping results thereby making the framework very adequate'. It was stated that 'with respect to the 'How-to-guide' The illustrative interpretations as examples of options of space design solutions in addition to the four stages of the guide were considered to be 'a very relevant aspect of the research…it illustrates how these guidelines can be adopted into practical design situations by HEIs'.. These comments further underpin the relevance of the findings.

CHAPTER TEN CONCLUSIONS AND RECOMMENDATIONS

10.0 INTRODUCTION

This is the final chapter which covers the presentation of the research conclusions generated from the main findings of the research and re-evaluation of the research aim, objectives, hypothesis, and research questions. The researcher's concluding comments, recommendations and the implication of the uptake of the e-learning space design framework developed have been discussed and suggestions put forward for possible further direction of the study with respect to the future of e-learning space design in HEI construction and the Industry at large. The chapter concludes with illustrative interpretations and notes of a conceptual design solution for a user defined multifunctional learning environment based on research findings. This was achieved through the use of Auto CAD Architectural Desktop and Google Sketch-Up 2010

10.1 CONCLUSION FROM RESEARCH FINDINGS

10.1.1 Space Design

From the outcome of the research exercise, the following were the conclusions that have been generated about the 'Space Design' within an e-learning environment with respect to the definition, factors for its design, space type, user preferences and space design attributes.

I. Conclusions on the Definitions of an E-learning Space and Space Types

E-learning Space can be defined as **'a space that has been fitted with technology supported learning facilities with inclusive design consideration for ease of accessibility and usage by all'.**

Other definition proffered by a respondent was **'an interactive studio'; facilities for distance learning e.g. video conferencing' and 'A combination of virtual space and physical space with facilities for both face to face and virtual contact for collaboration, sharing and using digital resources'**

An E-learning space was also defined as a **'space fitted with flexible furniture, IT and technology for multipurpose usage'.**

The seven space types which were initially identified from literature reviews were also seen to exist within the case studies investigated. These were:-

1. Group Teaching/ Learning Spaces
2. Simulated/ Special learning environments
3. Immersive/Virtual Spaces
4. Peer-Peer/ Social (Blended) Learning Spaces
5. Learning Clusters
6. Individual spaces
7. External Spaces

However, some of the spaces were new builds while others were renovations, refurbishments and upgrades.

From the case studies investigated, it can be concluded that **the most common factor that led to the execution of e-learning space design projects within the HEIs investigated was institution led**. Examples of the reasons given for these were:-

- Reconstruction works aimed at upgrading the Institutions learning environment and image,
- Change in management resulting in new space design,
- Availability of funding from the Institution and external sources
- The opportunity of developing the academic community into a centre for educational excellence aimed at having a perceived positive impact on economic regeneration and business development that will in turn restructure the social wellbeing of the neighbourhood
- The VC's strategy to upgrade the University facilities and technology.

From the analysis of data, **it can be concluded that another important factor responsible for the space designs were user led factors**, as seen in two of the case studies investigated. Examples of such factors include:-

- An increase in numbers of post graduate engineering students' enrolment resulting in need for more space
- The identification of the need to provide adequate spaces for the students, and the decision to turn existing dead spaces into usable areas
- An Institution's desire to support its students by providing additional learning spaces/ drop in centres for statistics and mathematics students

Other factors responsible for the space designs were technology led such as:-

- An Institutions desire to provide innovative, relevant and excellent services within the Institutions buildings and facilities
- The identification of the need for technological upgrade (facilities and equipment) as well as the teaching the students how to use technology facilities provided within the HEI

Other factors for space design which were rated high by respondents to the Executives' survey include the following:-

- It is part of the strategic vision of the University
- Changes in the University's educational philosophy e.g. from tutor-led to student led studies
- The recent and ever changing technological advancement
- The need for space to offer better services

II. Conclusion on User Preference of Space Types/Attributes

The analysis of quantitative data showed that majority of the users' indicated high ratings for various activities that their teaching and learning facilities enabled them to do. The rating scale could be used to determine user preferences of facilities and spaces types the highest rating were for spaces an facilities that enabled them to participate in collaborative teaching and learning, check e-mails and surf the web, access online study materials. The analysis of data obtained from the surveys supports the above results as it also showed that users **preferred Multipurpose or multifunctional spaces with the following attributes. Flexibility, personalisation, architectural attributes such as functionality, inspirational adequate ventilation, lighting, acoustic quality, circulation, inclusive design considerations and required level of technology provided.**

As stated by a forum participant, the design of e-learning spaces should not only incorporate limitless flexibility (i.e. adaptable, adjustable and multifunctional spaces) but should be personalised and customised; combining functionality and should be inspirational and focus on how to use the learning environment to achieve better performance.

From the foregoing it can be concluded that the users' expect that an ideal e - learning space design for the future technology learning environment should be defined as a space that incorporates the elements of multifunctional usage, flexibility, and ability to accommodate varied user requirements which can be personalised.

III. Conclusion on sources of Factors for Space Design

From the research findings, it can be concluded that the sources of factors that led to the majority of the space design projects investigated during the study were more often the e-learning visionaries' and the institutions choice of technology rather than user led factors even though the later were seen to be the case in some instances.

10.1.2 Conclusion on Technology- Usage and Adoption

Technology uptake and use within e-learning spaces was one of the constructs for analysis of findings. It was seen that most of the HEIs investigated had a medium to high rating for technology use. However the quality of the technology provided and effectiveness varied. Majority of users felt that their learning space was technologically efficient while a few felt it was not. From the analysis it can thus be concluded that a technologically efficient space would be defined by the following key attributes-:

- The spaces should be fitted with adequate and adaptable technology (preferably recent cutting edge features) required supporting teaching and learning requirement

- The spaces should be upgraded as often as when required

- The technology and equipment ought to be considered alongside the planning of the space layout of the teaching and learning environment

- The new build spaces should be initially designed as a technology focused environment

- The users' should be able to determine the space design and type of technology used within their teaching and learning environment

In addition to the above attributes obtained from the users' survey response, the studies looked at good practice examples from institutions outside the UK in order to evaluate research findings in this regard namely Ajman University of Science and Technology (AUST) UAE and MIT University US.

The response obtained from an Executive of AUST, UAE institution suggested that the following key attributes were thought to be essential for the technological efficiency of learning spaces within an HEI

- The right type of technology for the type of learning environment

-The appropriate space design for such technology- temperature/lighting control, space layout, space functionality/flexibility, accessibility and consideration for future expansion or change

- The need for spaces to offer better services

Other response obtained from the executive survey stated that 'ensuring space and technology mesh to facilitate learning'

10.1.3 Conclusion on the E-learning Research Focus

- It can be concluded that the findings of the study and subsequent analysis indicates that there was an impact of e-learning on facilities and design; in the response from the users survey majority of them indicated that the facilities and the space design of their learning environment was suitable for their learning requirement.
- It can be concluded that there is a need for HEI to involve users' in the design of future spaces and how we get there as the survey response showed that this aspect was often none existent because projects were often executed based on institutionally led factors rather than user requirements.

- It can be concluded that there was an increasing positive and good impact of blended learning on the design of spaces. As indicated in the research findings, most HEIs investigated had developed or were in the process of developing spaces that allow for blended learning (combination of different learning styles within one space)

- It can be concluded that some HEIs had spaces designed for the learn anytime, anywhere paradigm as indicated in the research finding from case studies investigated while others did not. It can therefore be argued that more institutions need to provide such spaces as the findings showed that the advantages of designing in this regard were flexibility, ability of learners to personalise their learning environment as well as increased opportunity for collaborative studies

- it can be concluded that there were few concerns about the security issues of e-learning and e-learning space design, as the findings indicated that most HEIs had security facilities in place as well as personnel. In addition to these, the users' were also seen to play an active role in protecting their spaces and facilities provided for them

- It can be concluded that the levels of design risk in an e-learning infrastructure as indicated by the research findings were relative and dependent on an Institution's project strategy, available funding/sources, and location of building, type of construction and purpose of the design.

- It can be concluded that inclusive design and its future direction was an area that most HEI needed to focus on as the research findings indicated that majority of users' designers and executives indicated that they were not disabled and as such it could be inferred that the response provided by them could not absolutely be used to conclude on the suitability of the features provided in the existing design. However, majority of survey respondents indicated that inclusive design considerations and features within their learning environment were considered to be adequate and suitable. Furthermore, the seven point protocol for inclusive design identified can be consulted as a guide for the future design in this regard.

10.2 CONCLUSION ON RESEARCH HYPOTHESIS, AND QUESTIONS

- It can be concluded that the two research hypothesis developed were proved to be true as indicated by the research findings thus:-

- The results from the desk studies and survey indicated adequately that; A user's learning experience can be improved by the provision of a good e-learning environment; as majority of users strongly agreed that this was the case therefore the initial assumption that good design of technology supported learning spaces has an impact on the users' learning outcomes was seen to be true.
- Based on research findings; different types of users' learning patterns were identified therefore the hypothesis that; user's learning requirements were different and varied was seen to be also true.

It can therefore be inferred that these two factors ought to be important criteria for consideration in e- learning space design.

- It can be concluded that the research questions were adequately answered (see section 9).

These findings informed the development of the proposed framework and 'Design how to guide' presented in chapter nine.

10.3 ACHIEVEMENT OF RESEARCH AIM AND OBJECTIVES

The aim of this research was to develop a novel methodology/framework for e-learning space design in HEI; that will subsequently be adopted into a toolkit to provide guidance for the design of future e-learning spaces & facilities particularly in HEI

I. Objective 1- To identify basic elements for good design in e-learning space design

This was achieved by carrying out detailed desk studies. They were as follows:-

- Provision of satisfactory ambient environmental factors; such as air quality, noise levels, ventilation, temperature, lighting and lighting control as the evidence indicated that these had an impact on learning.

- Identification of the key themes that shape space design from similar research:-

(I) Flexible open space- future proof space design achieved by using flexible furniture arrangement to reorganise the interior environment this encourages constant change as well as multiple space use

(II) A spectrum of spaces- providing a balance between flexible open spaces and private spaces such that there is something suitable for everyone

(III) The Institutions' expectations of students –The provision of learning environment that utilised technology incorporated a wide variety of seating styles and were designed like an open plan office.

(IV) A role for conversational learning- developing environments that are for people and their learning conversations

(V) Learning as a social process- providing a social framework for learning

(VI) Some characteristics of modern students- indicates that students are part of a creative society, therefore, making HEI buildings an experience through the introduction of fresh perspectives which encourages that more thought be put into how they appear and feel in greater detail will result in successful 21st century Universities- those that relate, and compete with, real world experiences ensuring that they remain relevant to the broadest possible section of society

(VII) The recognition of individual difference- the ability of HEI providers to recognise rather than ignore the existence of individual differences and the inherent variety of need exhibited by learners will ultimately help provide a new approach to what Institutions provides and how it provides it.

(VIII) The integration of IT in the building- in order to use the technology to connect learners rather than divide them

(IX) The importance of design- to facilitate the construction and preservation of numerous learning environments within a building

(X) Third places- provision of inspirational spaces for interaction, conversation and learning such as coffee shops, student hubs etc.

Other relevant elements of good space design identified were

- Increasing support for social, collaborative and blended models of learning
- More embedded use of audio-visual technologies
- Increasing hybridisation of spaces
- Flexibility in design, fittings and furniture to ensure sustainability
- Simultaneous support for f2f and virtual learning
- Support for innovative, experiential learning in f2f contexts
- A higher profile allocated to social areas supporting problem-solving and collaborative learning based around mobile and wireless and audio visual technologies
- Greater emphasis on developing learners' wider skills, especially creativity and adaptability'

In addition to the above the study also identified some other good elements of space design as follows-: **flexibility**, **future – proofed**- **boldness**- **creative**- **supportive**- and **enterprising**.

From the case studies, interviews and surveys, the good elements of space design identified can be summarised as follows-

- 'The design of e-learning spaces should not only incorporate limitless flexibility (i.e. adaptable, adjustable and multifunctional spaces) but should be personalised and customised; combining functionality and should be inspirational and focus on how to use the learning environment to achieve better performance'.

II. Objective 2- To identify essential user learning patterns that affect e-learning space design

- This objective was achieved by site based analysis of case studies (see section 9.3.1), conducting interviews and reporting of findings (see section 6.8.5 and 9.3.1) and by the development, administration and analysis of structured questionnaire survey to the three groups of respondents (see section 7.4 and 9.3.1).

The key design requirements from users' and the stakeholders involved in the design, finance and delivery of e-learning spaces were:-

- The need for good ventilation, lightening, temperature and noise control (acoustics). The reason for this could be that the, Inability to control these features causes frustration and tampering with controls. Localised controls – including operable windows – increase user satisfaction with open-plan spaces (Smith 2007)
- The need for understanding that any process needs to be interactive; A gradual transition is required as well as adequate user training
- Consideration for adaptable, adjustable and multifunctional spaces– flexibility in design.
- Personalisation was considered to be important – carrying the people along
-Buildings should have capabilities for the use of future technologies by incorporating functionality into different facilities and areas.
- Spaces should be adapted to the technologies available or provision of adequate technology should be considered
- There ought to be no gap between those that impose architectural solutions and the wishes and requirements of the user. This ought to be considered when designing for now and for the future through constant dialogue
- There should be allowance for progressive flexibility that is maintainable.
- It is a HEFCE requirement of Stakeholders to provide strategy that achieves student focused buildings; hence the utilisation of HEFCE guidance on space management and sustainability is essential to achieve collaboration between teaching and learning.

- The need for Functionality, Aesthetics and Innovative use of space within e-learning environment

- The need to always incorporate 'Inclusive design' features that allow for ease of accessibility and usage by all

- The need for inspirational open or closed flexible space layout options.

III. Objective 3-To develop a set of guidelines for good practice in e-learning space design

This objective has been achieved through the detailed analysis of data and the identification of good practice examples and the underlying factors that can then be developed into guidelines for achieving best practice designs in future (see section 9.4)
The guidelines developed are listed below;

- Avoid the creation of dead unusable spaces; -fitness for purpose/functionality

- Involve user participation in design projects; - Inclusive design consideration

- Incorporate vital architectural design elements; - Contextual fit, accessibility, build quality etc

- Provide the right space type, design and technology for the teaching and learning activity; - functionality/build impact

- Open dialogue between HEI to encourage benchmarking and prevent avoidable errors; - Due diligence

- Obtain proper guidance on furniture design, type, layout and procurement; - flexibility, efficiency & sustainability

- Adopt a phased construction strategy; - Project strategy/deliverable

- Design for physical security as well as security of software/data; -Providing safe and secure environment

- Provide outdoor learning spaces, user defined spaces as well as multifunctional spaces. - Flexibility, Adaptability and future proofing

- Design motivational, inspirational and aesthetically pleasing environments-aesthetics, build-impact and user satisfaction

IV Objective 4- To develop a model framework for the design of e-learning spaces

Following data analysis, a model framework was developed, consisting of three constructs, as described in Section 9.4.1; thus achieving Objective No.4 adequately.

V. Objective 5-To evaluate the framework and develop into a How-to-guide

The full evaluation of the framework on a life project requires considerable time, which was not available in this research. To circumvent this, expert opinion was used to validate the framework. In this regard, staff members outside the supervisory team were used to test the efficacy of the framework. (NB: the sampled opinion of staff was reported briefly; their affirmative views in section 9.5 have achieved objective No.5 considerably.

Secondary Objective - To disseminate results

The dissemination of research findings has been done through participation in poster design competitions (organised by the PG School University of Wolverhampton, 2007, 2008 and University of Brighton 2010), presentation of papers at peer reviewed conferences in Ulster Ireland and Penn State University, USA (i.e. Dare et al., 2010a; 2010b). As well as at the Built Environment and Engineering Research Seminars (BEERS) organised once a month by the School of Engineering and Built Environment, (now School of Technology STECH) University of Wolverhampton. The research outcomes will be submitted for relevant journal publication as well

10.4 RECOMMENDATIONS

The recommendations from this research can be summarized as:

Space Design: - E-Learning spaces should be multifunctional, multipurpose, flexible User defined spaces incorporating inclusive design considerations for usage by all

Technology: This should be adaptable and flexible; planned well in advance and alongside the space design.

ELSD Research Focus- the seven aspects of the E-learning research focus investigated should be considered along with the recommendations for space design and technology provision in order to deliver best practice Technology Supported Learning environments in future. The adaptation of the framework into the design ‘How to guide’ should be considered as a conceptual guidance in this regard.

10.5 RECOMMENDATIONS FOR FUTURE RESEARCH

The findings and developments from this research can be investigated further thus:

- The need to carry out evaluation of the developed framework and ELSD guide on a real life project in order to ascertain its relevance and usefulness to the design process of e-learning space design delivery in HEI.

- The need to carryout investigation about user requirements for users within other disciplines other than the sciences- Engineering and Built Environment.

- The need to identify good design examples outside the UK and carry out comparative studies about what obtains in the UK versus what is existing outside the UK to inform future designs.

- The possibility of increasing knowledge share between HEI and providing guidance through the development of a web based e-learning space design library of good practice accessible to all HEI.

10.6 GENERAL SUMMARY

This Chapter presented the conclusion and recommendations from the study based on the research findings documented in the preceding chapters (see chapter one to nine summaries)

It can be summarised that the research process was one that involved a Grounded theory approach at the onset which was useful in the development of theories. The majority of the data types required were qualitative in nature; however some quantitative data were also required. This then led to the consideration and use of a mixed methods design approach for the collation, and categorisation of the data in order to take advantage of 'its methodological pluralism or eclecticism' in order to present a superior research work (compared to the one-track-method of traditional research). Therefore the findings emerged from the varied data gathering tools and stages. The Data analysis was done using content analysis, case study analysis as well as thematic analysis within the context of an eclectic study.

The findings of an in-depth, investigation of the subject area were used to develop the ELSD frame work in which the three main constructs of Space design, Technology use/adoption and the Research focus (users' requirement) emerged as the important components and factors for achieving future e-learning space design on HEI Campuses. These along with the ten point guidelines were then used to develop the four steps How – to-guide thereby enabling the achievement of the research goals.

It is hoped that the study outcome will contribute to the body of knowledge through this noble endeavour along with the dissemination of findings through publications. The recommendations and future exploitation for the research discussed are however not exhaustive but should be considered as future possibilities.

The researcher's concluding remark would be that it was a worthwhile venture, however 'Design is but a language; if you have nothing to say it won't help you'. '… Enterprising is needed - a never-failing will to create only the best – to persistently find new ways of improvement'…while imbibing the values of 'excellence, synthesis, originality and passion' (Bang & Olufsen, 1970, 2002, 2007). To this end, it should be understood that there are varied solutions to design as exhibited by the works of Masters of Architecture: Frank Lloyd Wright, Le' Corbusier, Frank Ghery, Louise Van-Der-Veldt, Sir Norman Foster to mention but a few. Whose interpretation of design and space were varied, unique and unequivocal.

The design sketches (3d visualisations) produced should be considered only as a noble attempt to interpret user requirements and proffer guidance to e-learning space design problems identified, and investigated by the researcher as it were.

The 3D visualisations produced are based on conceptual designs developed by the researcher, the drawings were produced with the Autodesk Architectural desktop software 2007 and the visualisations were produced using Google sketch up software 2010. The explanatory notes and 3d visualisations are included below.

The visualisations A1 drawings begin with the redesigning of a conceptual example of the traditional general teaching and learning space. The bespoke space has regular type windows, furniture/space layout being the classic tutor led layout where by students were usually sat facing forward in one direction. This situation is somewhat functional and allows the tutor maximum control but has been considered boring and un-motivational as well as restrictive for learners. The adjourning space is also a conceptual traditional layout of an informal study environment which was often considered to be functional but in reality was also considered boring and un- motivational; as well as having a dead space in the centre it is also restrictive. The next set of visualisations (B1) show an improvement in the layout to allow for collaborative studies. The window sizes are bigger than those in the (A1) set drawings which do not allow maximum lighting come in. The next sets of visualisations (C1-D1) are an improvement on the previous in terms of space layout, furniture, lighting, as well as technology equipment. The space designs include the incorporation of technology supported learning facilities such as LCD screens as well as having a more flexible furniture layout. The final set of visualisations E1 are based on a conceptual e-learning space albeit a corridor design that could be made more inclusive and adapted for e-learning in order to show how dead spaces can be used in order for learning to take place anywhere and at any time.

10.6.1 Notes on the 3D Visualisations Developed.

A1 Drawings- depicts a conceptual design, floor plan and 2 interior perspective views of a traditional classic style teaching and learning space let's say a classroom.- it is tutor led, un- inspirational, restrictive and rather boring. The architectural elements and basics such alighting, ventilation, functionality, acoustics, circulation, space layout etc., need to be addressed.

B1 Drawings-depicts the above conceptual scenario but with notable improvement on the space arrangement and layout, as well as the basic architectural elements, lighting, orientation and circulation in order to achieve a motivational, multifunctional space where different users can personalise their study environment.

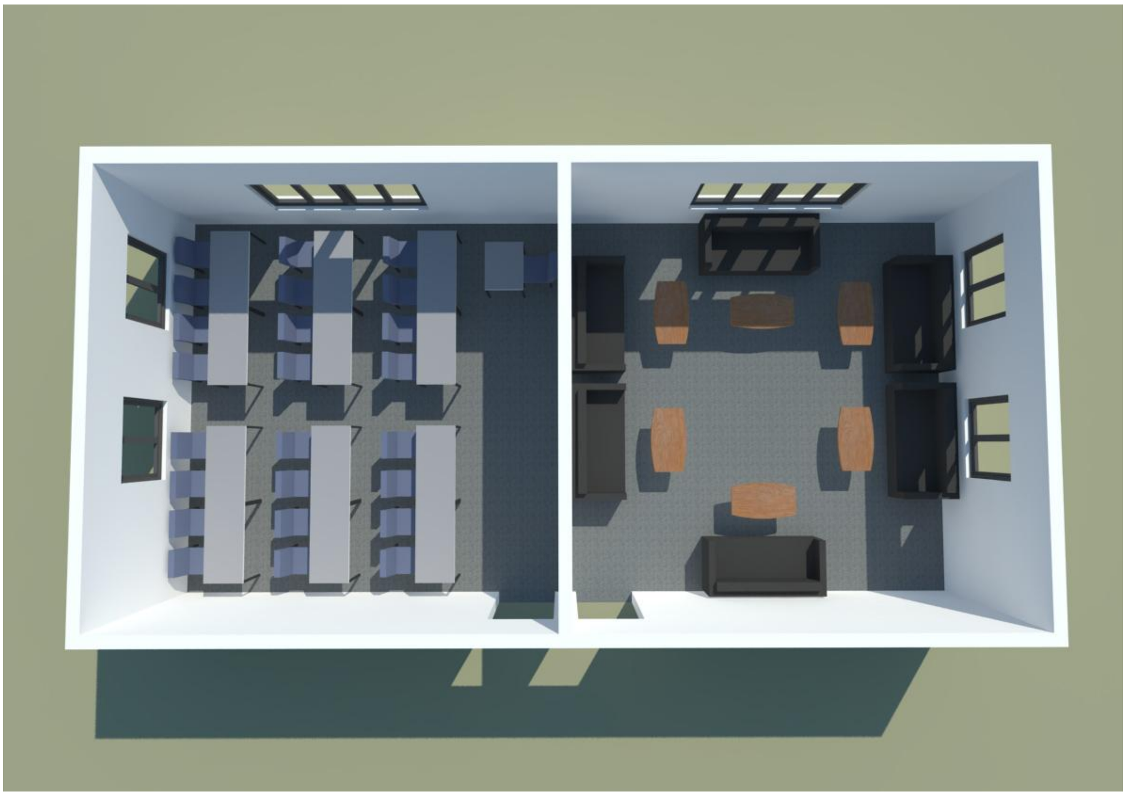
C1 Drawings- depicts the same spaces collapsed into one huge learning space with provision of collapsible partition boards instead for spaces to be subdivided rather than the fixed dividing wall this further opens up the learning space for more flexibility in use and layout.

D1 Drawings –depicts yet another improvement on the afore said space with introduction of technology features from the usual basics to provision of LCD screens for online real-time virtual learning as well as provision of essential technology facilities to support learning.

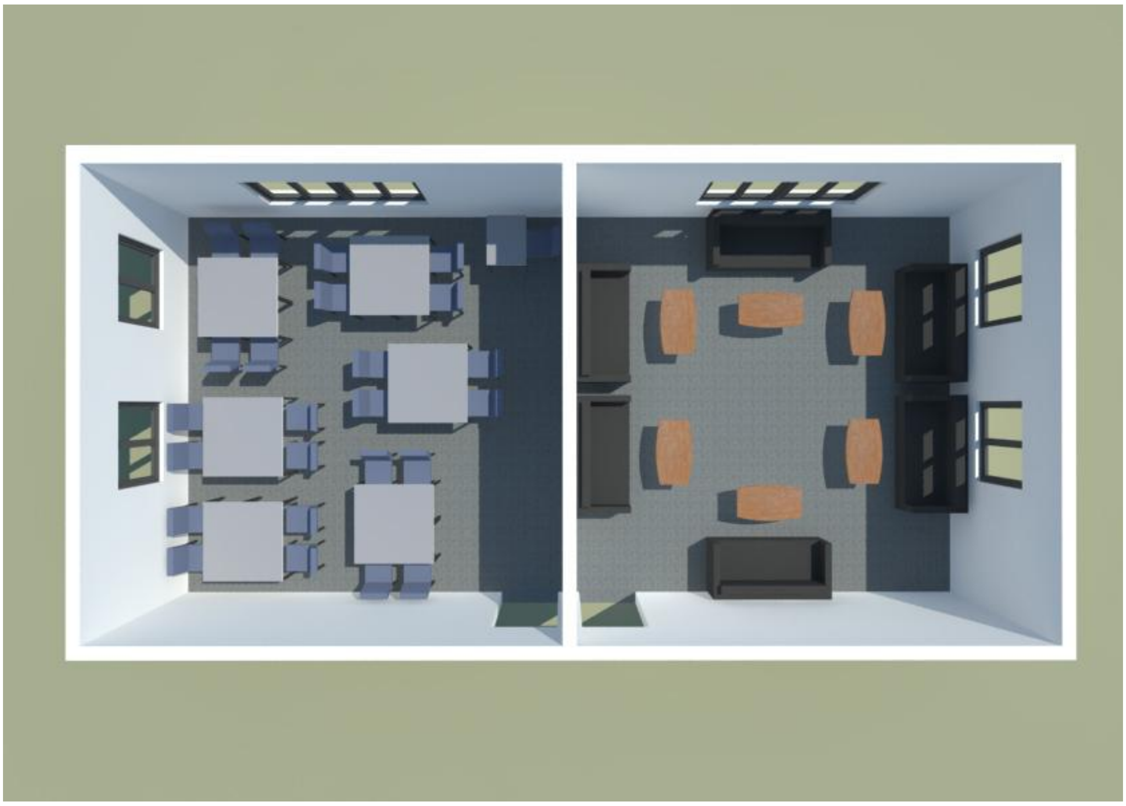
E1 Drawings- depicts a conceptual corridor space which would otherwise lead to a dead end or be a dead space as it were assuming it was at the end of a set of classrooms. The researcher tries to show how this can be adapted into a user- led e-learning space with technology features such as Wi-Fi, LCD screens, wide corridor space, proper lighting, furniture and layout as well as durable fittings and finishing

A1a Visualisation- Traditional Teaching and Learning Classroom (formal layout)

A1b Visualisation- Traditional Teaching and Learning Classroom (in-formal layout)



A1a plan

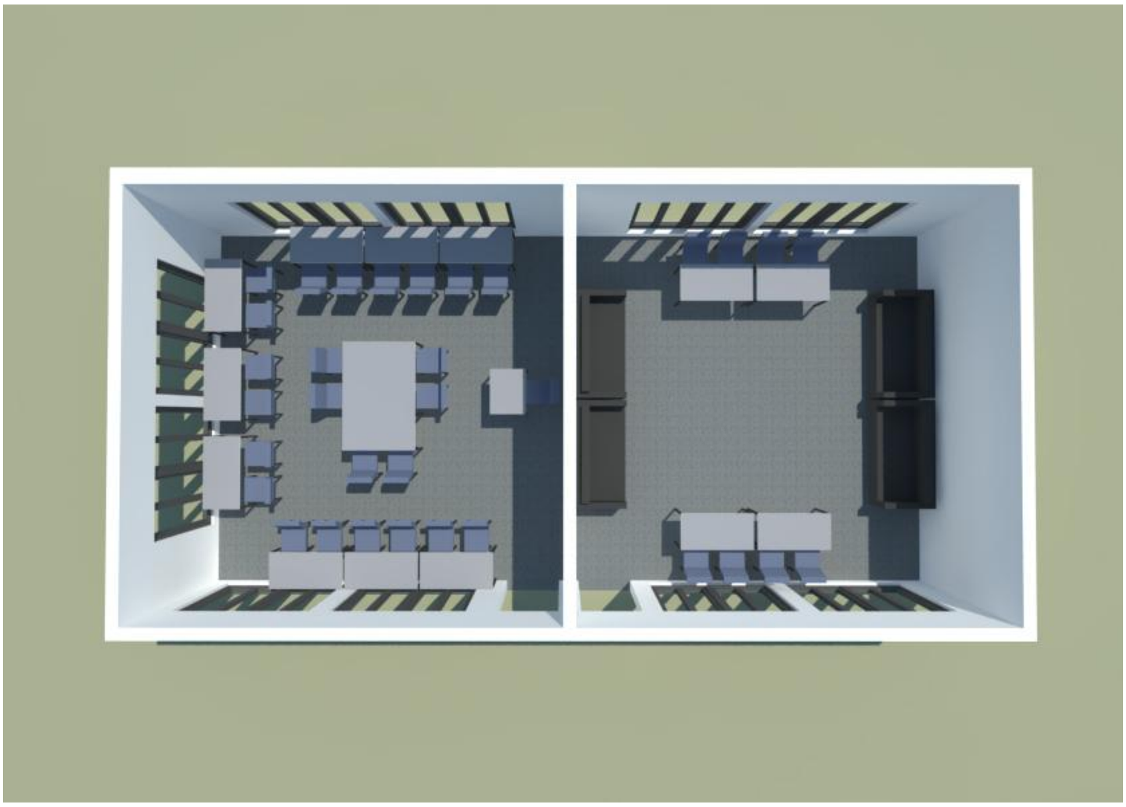


B1 plan

B1a- Visualisation of Space with Different Space Layout

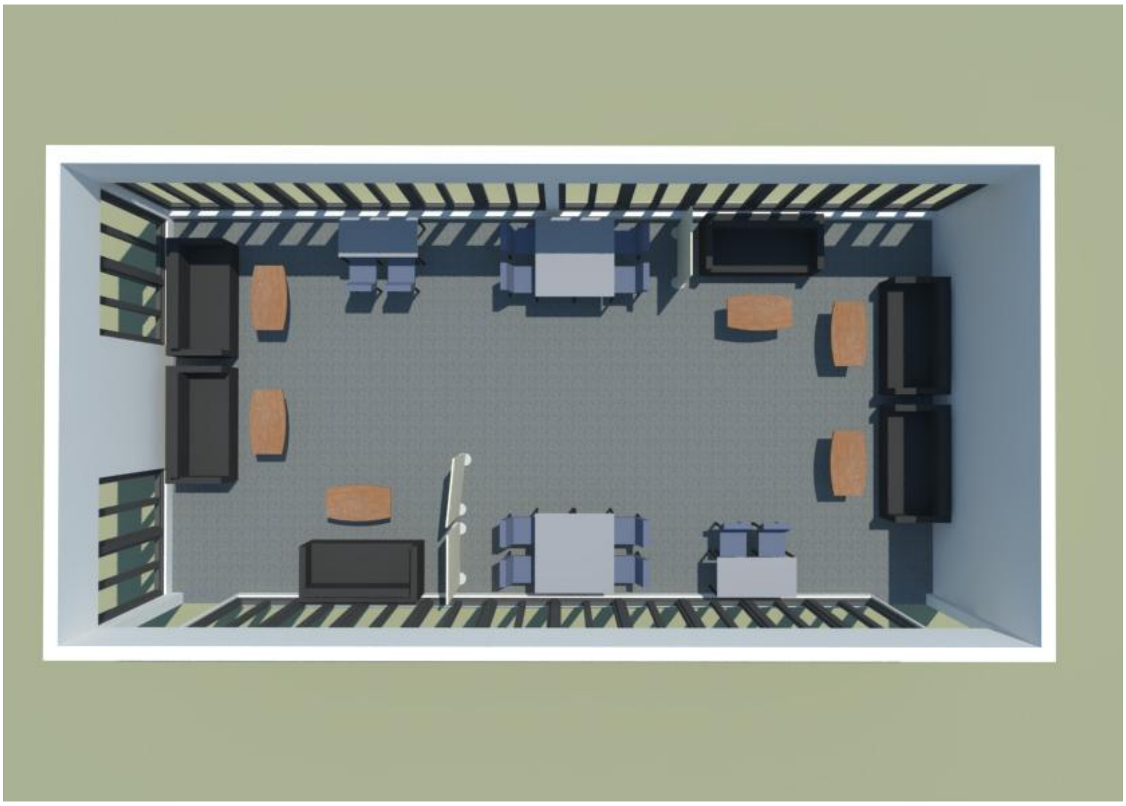
B1b- Visualisation of Space with Different Space Layout, window size for more lighting

B1c- Visualisation of Space with Different Space Layout



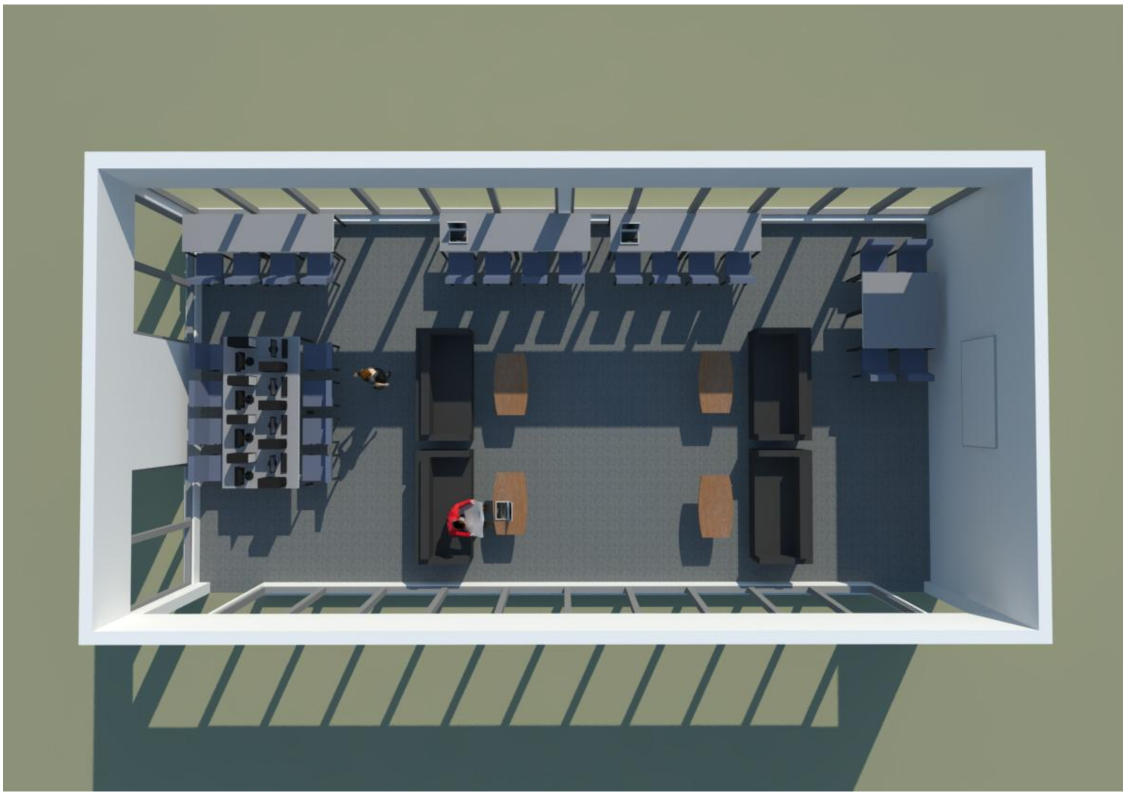
B1-plan ii

C1a-Visualisations of Space opened up/partitioned to allow Flexibility in use and layout.



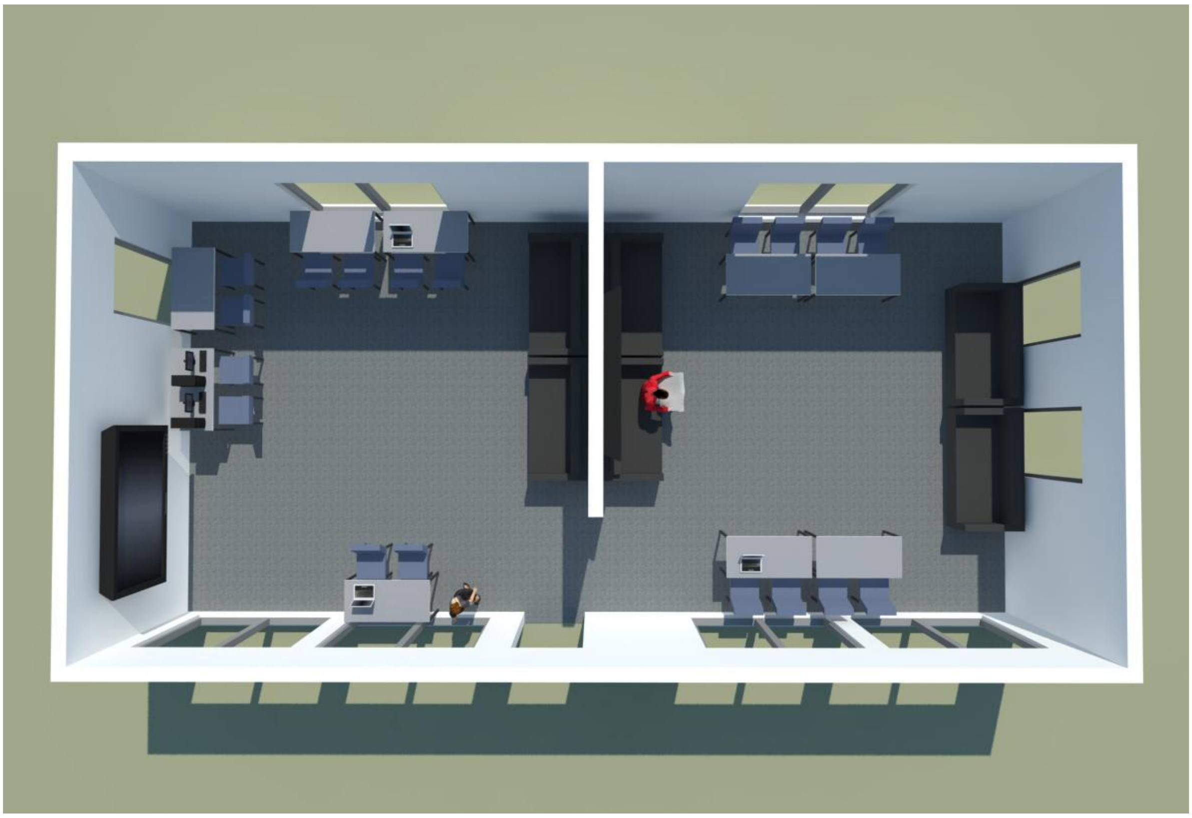
C1 plan

D1a Visualisations- Space improvements in layout and basic technology provision



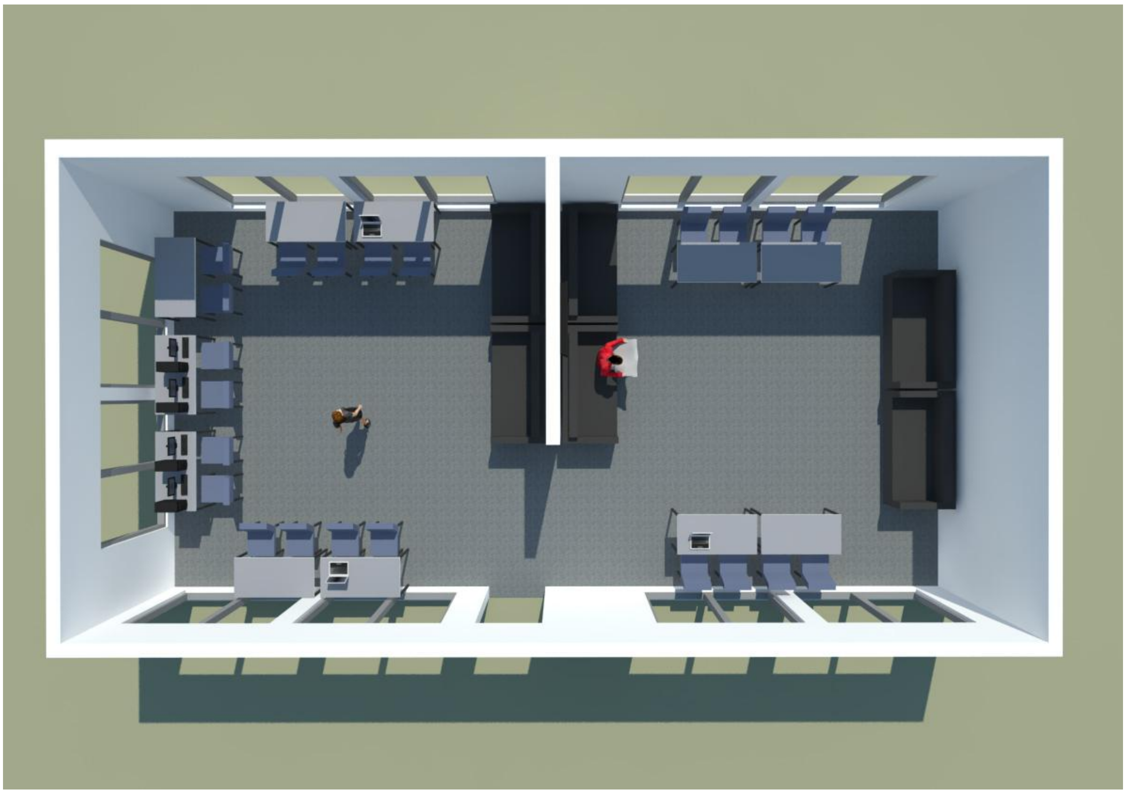
D1- Plan

D1a Visualisation – Space Fitted out for VLE, Individual or Group Study



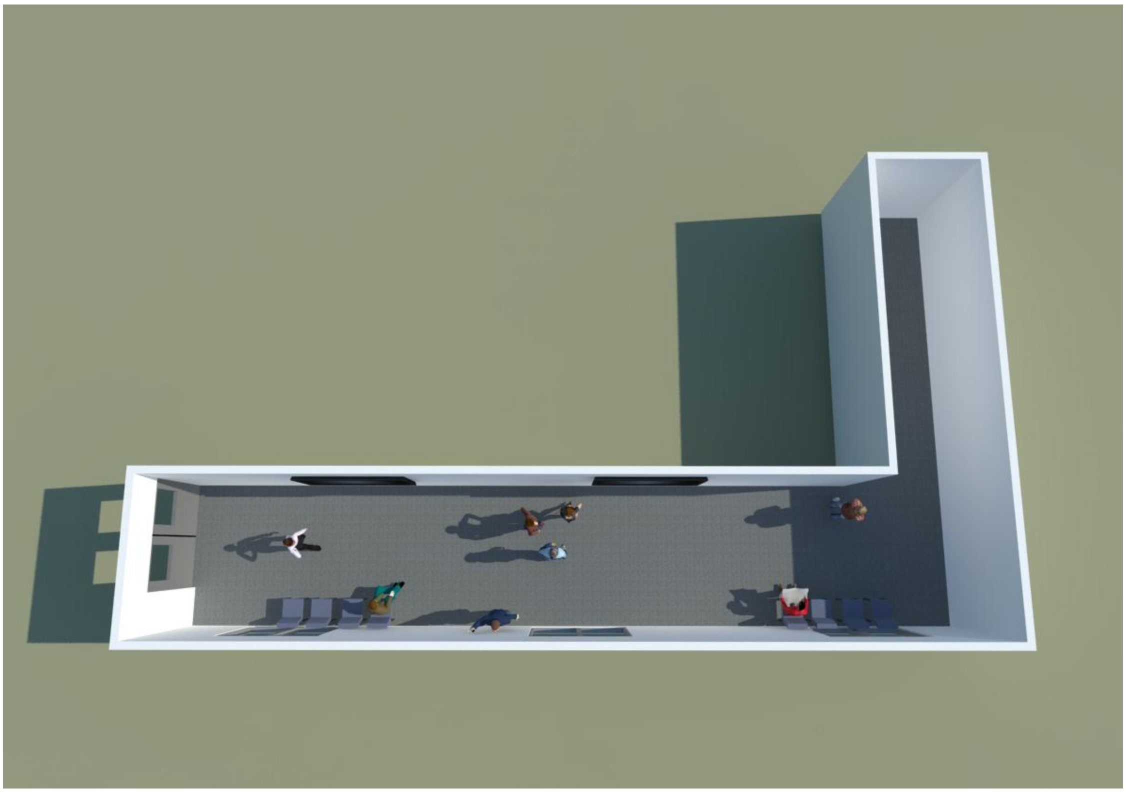
D1a-Plan

D1b Visualisation -Space Fitted with Technology and Facilities for VLE, learning Clusters etc.



D1b -Plan

E1- Visualisation A Corridor Space Design for Learn Anywhere –Anytime Scenario



E1- plan

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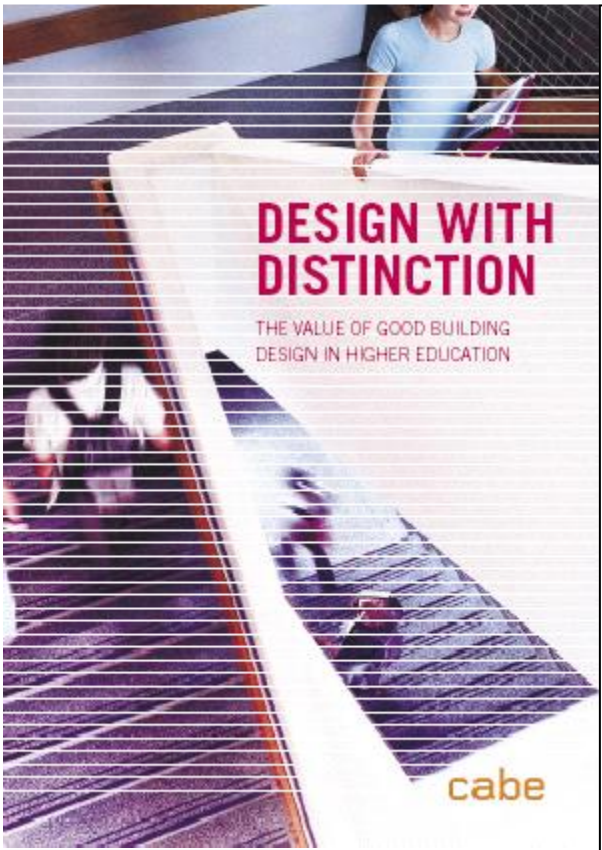
Appendix A

The Leadership Governance and Management Fund (LGMF) Draft 2 for HEFCE Strategy 2005 pp. 3-5



This March 2005 report "The Value of Good Building Design in Higher Education" was published by the Commission for Architecture and the Built Environment. CABE is funded jointly by the Department for Culture, Media and Sport and the Office of the Deputy Prime Minister. This work was funded by the four UK HE funding councils and also involved the Association of University Directors of Estates.

We want to build on the work in this document which mainly covered building design in relation to recruitment, retention and performance of staff and students.

E-learning was not covered – our project is focussed on how good building design can facilitate effective e-learning on campus. The CABE project was presented by Professor Robert Grimshaw of the University of the West of England at the HEDQF Conference in 2004.

Please describe how this project will benefit the higher education sector (max 500 words) explaining in particular:

a. What outputs will be produced (that is, the end product deliverables of the project)
b. What outcomes (that is, beneficial changes in leadership, governance and management within the higher education sector) will be generated by the project.
c. How the findings of the project will be disseminated to other higher education institutions.
d. How the sector will continue to receive benefits from the work after the project is formally complete.

This project will seek to address the concerns expressed in section 16 of the HEFCE strategy for e-learning from the stand points of:

- The impact of e-learning on facilities and design
- The design of future spaces and how we get there
- The impact of blended learning on the design of spaces
- Designing for the learn anytime, anywhere paradigm
- The security issues of e-learning and e-learning space design, and
- The levels of design risk in an e-learning infrastructure.

And as such will be of significant benefit to the HE sector in identifying good practice and providing sectors wide guidance in the design of e-learning environments.

a) The deliverables of the project will be: -

- A web-based and audio-visual library of good practice.
- An HEDQF touring exhibition from the web-based library.
- Papers and publications on findings regarding the current situation and guidance in the design of e-learning environments
- Conferences/workshops of good practice and guidance as part of the HEDQF programme. HEDQF would use its links with AUDE as part of the promulgation process. The HEDQF Conference attracts an attendance of over 100 delegates per annum and it is envisaged that workshops across the sector would attract participants of 50 plus.

b) The project will identify good practise and produce guidance for the design of e-learning environments, with the dual aims of: -

- "Supporting the HE sector as it moves towards embedding e-learning appropriately, using technology to transform higher education into a more student-focused and flexible system, as part of lifelong learning for all who can benefit" and
- "Enabling institutes to meet the needs of learners and their own aspirations for developments".

(HEFCE strategy for e-learning, March 2005/12 Sections 21 and 22).

c) The findings of the project will be disseminated as in section 4 above.

It is anticipated that at least one single day conference of over 100 delegates plus four workshops of 50 delegates each would be envisaged. The web-based audio-visual library, a touring exhibition, papers and publications would supplement these events.

d) After the project is formally complete HEDQF will continue to monitor developments in the design of e-learning environment.

In addition, HEDQF would conduct a brief review, via its own resources of the end products of the research in 3 to 5 years' time and would then produce a report on further developments of good practice.

It will then continue to disseminate information as appropriate as part of its on-going programme.

Appendix B- List of March Forum Participants

Appendix B-List of March Participants

Forum for E-learning Space Design Best Practice on Campus
University of Wolverhampton
Event Enquiries: FADEKE TAIYE ADEJUMO Tel: 01902 321284
Email: f.adejumo@wlv.ac.uk

Attendance sheet March 22 2007

S/N.	Names	Organisation/position
1	Participant 1	Cardiff University-Head Teaching and Learning Centre
2	Participant 2	Leeds Metropolitan University/Lecturer
3	Participant 3	Leeds Metropolitan University/IT Staff
4	Participant 4	Leeds Metropolitan University/Snr. Lecturer
5	Participant 5	Newcastle University/IT Staff
6	Participant 6	Newcastle University/ IT Staff
7	Participant 7	Newcastle University/ IT Staff
8	Participant 8	University of Wales Bangor/Principal Lecturer
9	Participant 9	University of Wales Bangor/ IT Staff
10	Participant 10	University of Wales Bangor/Lecturer
11	Participant 11	University of Warwick/Lecturer
12	Participant 12	R. N. Associates/Executive Consultant
13	Participant 13	University of Wolverhampton/Research Student
14	Participant 14	University of Wolverhampton/Researcher
15	Participant 15	University of Wolverhampton/Staff
16	Participant 16	University of Wolverhampton/Supervisor 1
17	Participant 17	University of Wolverhampton/Executive Dean SEBE
18	Participant 18	University of Wolverhampton/Project Manager
19	Participant 19	University of Wolverhampton/Head CTL
20	Participant 20	University of Wolverhampton/Researcher in COIN

Appendix C-List of April Forum Participants

Forum for E-learning Space Design Best Practice on Campus
University of Wolverhampton
Event Enquiries: FADEKE TAIYE ADEJUMO Tel: 01902 321284
Email: f.adejumo@wlv.ac.uk

Attendance sheet March 22 2007

S/N.	Names	Organisation/position
1	Participant 1	Leeds Metropolitan University/Lecturer
2	Participant 2	HEFCE – Regional Co-ordinator
3	Participant 3	Leeds Metropolitan University/IT Staff
4	Participant 4	University of Reading/Snr. Lecturer
5	Participant 5	Furniture Consultants Ltd
6	Participant 6	University of Essex/Director of Estates
7	Participant 7	UCE Birmingham/Academic Staff
8	Participant 8	UCE Birmingham/ Executive Staff
9	Participant 9	University of Reading/ IT Staff
10	Participant 10	W.L Associates
11	Participant 11	AMA Consultanfs
12	Participant 12	R. N. Associates/Executive Consultant
13	Participant 13	University of Wolverhampton/Research Student
14	Participant 14	University of Wolverhampton/Researcher
15	Participant 15	University of Wolverhampton/Staff
16	Participant 16	University of Wolverhampton/Supervisor 1
17	Participant 17	University of Wolverhampton/Executive Dean SEBE
18	Participant 18	University of Wolverhampton/Project Manager

Appendix D/1- E-Learning Forum Invitation Letter

Dear Sir/Madam

Forum for E-learning Space Design Best Practice on Campus

The University of Wolverhampton was successful in securing funding from the Higher Education Funding Council for England (HEFCE) to carry out research into the area of best practice designs for enhancing e-learning spaces on campus. The project examines how Higher Education Institutions can design spaces and buildings to provide a more effective e-learning experience.

Further to this, we invite you to participate in a one day forum on "**E-Learning Space Design; Best Practice for Designing Physical Learning Environments within Higher Education Institutions",** at the University of Wolverhampton. Forums will be run on February 22nd, March 22nd and April 26th 2007 and you are invited to attend on any of these dates. A further detailed programme is enclosed.

The purpose of the forum is to follow up on the recently concluded JISC e-learning conferences / Space Management Group (SMG) Report; and will seek to inform participants through workshop and brain storming sessions of strategies and current methods of achieving good designs.

The forum is **free** for attendees and complimentary lunch will be served. Participants will also be able to take part in a guided tour of the University of Wolverhampton's recent E-Learning focused spaces and buildings.

If you are interested in attending one of these forums, please fax back the enclosed response form. If you would like further information on the project, please contact Adejumo Fadeke Taiye on f.adejumo@wlv.ac.uk or 01902 321284 or alternatively visit the project web site at http://www.elearningspacedesign.org.uk

We look forward to your participation at this event.

Yours faithfully

Prof. Paul Olomolaiye
Dean, School of Engineering and the Built Environment
University of Wolverhampton.

Forum for E-learning Space Design Best Practice on Campus
University of Wolverhampton

Programme of Events

10.00 – 10.30	Registration and coffee
10.30	Welcome
10.40	Introduction and overview
10.55	Introduction to e-learning space design/ good design practice in HEIs
11.10	Outline and description of what has been achieved with the e-learning environments at the University of Wolverhampton
11.30	Coffee
11.45	Breakout session 1: Group discussion on one of the following options • The impact of E-learning on facilities and design • The design of Future spaces and how we get there • The security issues of e-learning space design • Risks when designing e-learning infrastructures • The strategy and approach to achieving best practice design
12.30	Lunch
1.30	Breakout session 2: Group discussion
2.15	Feedback on breakout discussions
2.40	Plenary session
3.00	Coffee
3.15	Group tour of University of Wolverhampton's e-learning infrastructure
4.00	Review of the days events and address by board member of HEDQF
4.30	Close

FAX BACK TO 01902 322754

Forum for E-learning Space Design Best Practice on Campus
University of Wolverhampton
MI Building Room __________

Please respond today to reserve your place by fax to; 01902 322754

Event Enquiries: FADEKE TAIYE ADEJUMO Tel: 01902 321284

E-Learning Space Design Research Associate
School of Engineering and the Built Environment
MA 110A
University of Wolverhampton
Wulfruna Street, Wolverhampton
WV1 1SB
Tel: 01902 321284
Fax: 01902 322754
Email: f.adejumo@wlv.ac.uk

Personal information

Title	Mr/Mrs/Ms/Miss/Dr/Prof
First Name	
Surname	
Position	
Organisation	
Address	
Town/City	
County	
Post code	
Telephone	
Mobile	
Fax	
Email	
Special dietary requirements	
Special access needs	
Forum Attendance Date (please circle)	**February 22nd 2007 / March 22nd 2007 / April 26th 2007**

I am unable to attend this event on any of the dates above ☐

Please include me on your email database for any similar forthcoming events ☐

Please remove me from your mailing list ☐

FAX BACK TO 01902 322754

Appendix D2 Ethics Letter for Survey and Interview

University of Wolverhampton

School of Engineering & The Built Environment

APD Dept. MA 109f

Wolverhampton

WV1 1SB

01/11/2007

A NOVEL METHODOLOGY FOR THE DESIGN OF E-LEARNING SPACES ON CAMPUS

Information Sheet

Dear Potential Participant,

My name is ADEJUMO FADEKE TAIYE, and I am a Research Student [PhD.] at the University of Wolverhampton working under the supervision of Dr. David Heesom, Mrs Angela Nash and Prof. Paul Olomolaiye. As a part of my programme I am carrying out a study into the design of e-learning spaces in HEIs these are spaces such as general teaching spaces, vocational spaces and learning centres, to determine the impact of e-learning spaces on the users. The study aims to develop a new model that will provide guidance on how to (a) Integrate design quality standards into the process of delivering e-learning environments in HEI construction, (b) identify key requirements', from both the end users and stakeholders' perspective and (c) help build up a web based library of best practice examples which will ultimately upgrade best practice performance in this regard.

I would like to invite you to participate in the above research project, as your institution has been identified either through your participation in the three part E-learning Forums organised by the University of Wolverhampton, or by recommendation from the AUDE contacts in the HEI network we hope that your participation will help us identify spaces that can be used as best practice examples amongst other things.

Completion of the attached questionnaire will take approximately 8 minutes, and all questions can be answered by following the simple instructions. Completion of the questionnaire is completely voluntary. All responses are anonymous, there are no correct or incorrect answers and respondents who take part will not be identifiable. If results of this study are published they will be a summary of all responses to ensure that your privacy is protected.

Returning this questionnaire will be considered as your consent to participate in the survey.

ADEJUMO F.Taiye.

Appendix D/3- Reply Letter to Participants

E-learning Space Design Best Practice on Campus

University of Wolverhampton

City Campus

01-12 2008

Dear Participant,
We would like to know if the data and materials gathered from the Case study and Interview on good examples of E-Learning Space Design in your Institution meets with your approval.
I have attached a draft for you to read and comment on. You may wish to amend were necessary possibly with a different coloured font or style. Also there are some sections that require your contribution as well indicated in italics.

Your prompt response will be appreciated. Kindly send back a corrected copy by e-mail attachment as soon as you can.

Yours sincerely
Taiye

Enquiries: FADEKE TAIYE DARE (ADEJUMO) Tel: 01902 321284 Fax: 01902 322754
Email: f.adejumo@wlv.ac.uk

Appendix E/1

Users' Survey Results for: A NOVEL METHODOLOGY FOR E-LEARNING SPACE DESIGN ON HEI CAMPUSES.

1) **General** **Questions**
What user group do you belong to? (please tick as appropriate)

	Percentage	Responses
Student	55.2	16
Staff	41.4	12
Other	3.4	1
	Total responses:	**29**

2) If you are a Staff, please what category do you belong to?

	Percentage	Responses
Teaching Staff	20.7	6
Administrative Staff	6.9	2
Research Staff	13.8	4
N/A	34.5	10
Other	24.1	7
	Total responses:	**29**

3) How many years of experience do you have as a Staff? Please select n/a if you are not a Staff

N/A	Less than 2	2 – 5	6 – 10	10 – 15	15 – 20	20 and Above	Responses	Average Score
17 (58.62%)	1 (3.45%)	3 (10.34%)	2 (6.90%)	1 (3.45%)	3 (10.34%)	2 (6.90%)	29	2.52 / 7 (36.00%)
								2.52 / 7 (36.00%)

4) If you are a Student, what is your mode of study? Please select n/a if you are not a student

	Percentage	Responses
Full Time	69.0	20
Part Time	0.0	0
N/A	27.6	8
Other	3.4	1
	Total responses:	**29**

5) What is your age group?

Under 20	20 – 29	30 – 39	40 – 49	50 – 59	60 or Above	Responses	Average Score
0 (0.00%)	8 (27.59%)	**11 (37.93%)**	7 (24.14%)	2 (6.90%)	1 (3.45%)	29	3.21 / 6 (53.50%)
							3.21 / 6 (53.50%)

6) What is your field of specialty/study?

	Percentage	Responses
Please select	0.0	0
Applied Science	0.0	0
Arts and Design	3.4	1
Accounting and Finance	0.0	0
Agriculture and Forestry	3.4	1
Anatomy and Physiology	0.0	0
Business & Administration	6.9	2
Communication and Media	3.4	1
Computing & IT	3.4	1
Education	0.0	0
Engineering & the Built Environment	31.0	9
Health & Wellbeing	3.4	1
Hospitality; Leisure; Sport; Recreation and Tourism	0.0	0
Librarianship and Information Management	0.0	0
Law and Social Sciences	6.9	2
Other	37.9	11
	Total responses:	**29**

7) What is your gender?

	Percentage	Responses
Male	55.2	16
Female	44.8	13
	Total responses:	**29**

8) Would you consider yourself as having any form of disability or medical condition requiring additional support?

	Percentage	Responses
Yes	3.4%	1
No	96.6%	28
	Total responses:	**29**

9) **Questions on the Use of E-Learning Facilities**
Please grade in order of priority where (1) is the lowest and (5) is the highest

The teaching and learning facilities provided enables me to:-

	1	**2**	**3**	**4**	**5**	**Responses**	**Average Score**
Participate in collaborative teaching & learning	0 (0.00%)	3 (10.34%)	9 (31.03%)	6 (20.69%)	**11 (37.93%)**	29	3.86 / 5 (77.20%)
Check emails and surf the web	1 (3.45%)	1 (3.45%)	6 (20.69%)	5 (17.24%)	**16 (55.17%)**	29	4.17 / 5 (83.40%)
Undertake quiet study	1 (3.45%)	5 (17.24%)	**11 (37.93%)**	7 (24.14%)	5 (17.24%)	29	3.34 / 5 (66.80%)
Participate in tutorials and practical training sessions	2 (6.90%)	3 (10.34%)	**9 (31.03%)**	8 (27.59%)	7 (24.14%)	29	3.52 / 5 (70.40%)
Access online teaching and studying materials	0 (0.00%)	1 (3.45%)	6 (20.69%)	**11 (37.93%)**	**11 (37.93%)**	29	4.10 / 5 (82.00%)
Carry out presentations	0 (0.00%)	2 (6.90%)	**9 (31.03%)**	**9 (31.03%)**	**9 (31.03%)**	29	3.86 / 5 (77.20%)
Conduct research work, analysis or experiments	1 (3.45%)	3 (10.34%)	6 (20.69%)	**12 (41.38%)**	7 (24.14%)	29	3.72 / 5 (74.40%)
							3.80 / 5 (75.91%)

10) **Space Design Questions**

Which of the following do you understand by the term ‘an e-learning space’ or ‘a technology supported learning environment’? Please select all that apply

	Percentage	Responses
A space that incorporates social activities with informal learning facilities like a cyber café for blended learning	11.1	8
A space that has been fitted with IT facilities, digital technology and media for teaching & learning only	22.2	16
A space that has been fitted with technology supported learning facilities with inclusive design consideration for ease of accessibility and usage by all	30.6	22
A space fitted with flexible furniture, IT and technology for multipurpose usage	19.4	14
Learning through online (virtual) facilities only e.g. long distance learning	12.5	9
Other	4.2	3

11) As an end user, what is your opinion of the overall space design of the teaching and learning facilities of your institution, within the parameters of Functionality, aesthetic quality and the innovative use of space? Please tick where (1) is very good (4) poor.

	1 very good	2 fair	3 satisfactory	4 poor	Responses	Average Score
Functionality	**12 (41.38%)**	11 (37.93%)	6 (20.69%)	0 (0.00%)	29	1.79 / 4 (44.75%)
Aesthetic quality	5 (17.24%)	**14 (48.28%)**	7 (24.14%)	3 (10.34%)	29	2.28 / 4 (57.00%)
Innovative use of space	**10 (34.48%)**	9 (31.03%)	8 (27.59%)	2 (6.90%)	29	2.07 / 4 (51.75%)
						2.05 / 4 (51.17%)

12) Which of these space design solutions effectively supports your teaching and learning requirement within your school? Please select all that apply

	Percentage	Responses
Open space plan arrangement i.e. no walls	7.5	5
Enclosed space plans (i.e. with walls or glass partitioned areas)	22.4	15
Flexible furniture arrangement to allow for multipurpose use	23.9	16
Enclosed spaces without glass partitioned areas preferably opaque walls	7.5	5
Spaces fitted with good lightening,	31.3	21

ventilation and acoustics to absorb sound during collaborative learning			
Fixed furniture arrangement to allow for formal teaching and learning		7.5	5
None of the above (e.g. I study at home)		0.0	0
Other		0.0	0

13) **Questions on the Impact of Space Design on Teaching and Learning**

Do you think that the space design of the teaching and learning environment has improved your teaching and learning experience, please tick where (1) strongly agree and (4) strongly disagree

1 Strongly agree	2 Agree	3 Disagree	4 Strongly disagree	Responses	Average Score
9 (31.03%)	**16 (55.17%)**	4 (13.79%)	0 (0.00%)	29	1.83 / 4 (45.75%)
					1.83 / 4 (45.75%)

14) What aspects in your opinion has enabled your teaching and learning experience when using the institution's facilities for your study or work? Please grade in order of preference where (1) is the lowest and (5) is the highest

	1	2	3	4	5	Responses	Average Score
The location and design of the stairs and lifts	7 (24.14%)	5 (17.24%)	**12 (41.38%)**	3 (10.34%)	2 (6.90%)	29	2.59 / 5 (51.80%)
The acoustics (Sound/noise control levels)	3 (10.34%)	3 (10.34%)	**13 (44.83%)**	5 (17.24%)	5 (17.24%)	29	3.21 / 5 (64.20%)
The furniture type and their arrangement	2 (6.90%)	1 (3.45%)	**13 (44.83%)**	8 (27.59%)	5 (17.24%)	29	3.45 / 5 (69.00%)
The space design and layout (flexible, adaptable & multifunctional spaces)	3 (10.34%)	4 (13.79%)	**8 (27.59%)**	7 (24.14%)	7 (24.14%)	29	3.38 / 5 (67.60%)
The location of all fittings & services e.g., IT, Toilets, Stairs, Lifts, Vending Machine etc.	3 (10.34%)	3 (10.34%)	**13 (44.83%)**	5 (17.24%)	5 (17.24%)	29	3.21 / 5 (64.20%)
Circulation design (how people access the	4 (13.79%)	2 (6.90%)	6 (20.69%)	**9 (31.03%)**	8 (27.59%)	29	3.52 / 5 (70.40%)

building and move about)							
The ventilation design	2 (6.90%)	3 (10.34%)	**13 (44.83%)**	9 (31.03%)	2 (6.90%)	29	3.21 / 5 (64.20%)
The lighting levels (natural/artificial)	2 (6.90%)	2 (6.90%)	8 (27.59%)	**10 (34.48%)**	7 (24.14%)	29	3.62 / 5 (72.40%)
							3.27 / 5 (65.48%)

15) Do you feel that the space design of the teaching and learning environment is suitable for your requirements? Please tick where (1) is very suitable and (4) is very unsuitable.

	1 very suitable	2 fairly suitable	3 unsuitable	4 very unsuitable	Responses	Average Score
	12 (41.38%)	**13 (44.83%)**	4 (13.79%)	0 (0.00%)	29	1.72 / 4 (43.00%)
						1.72 / 4 (43.00%)

16) Some inclusive design considerations within the space design of the teaching and learning environment are listed below. Please grade them according to their effectiveness within your institution where (1) is the lowest and (5) the highest

	1	2	3	4	5	Responses	Average Score
Wide corridors and doors for wheel chair users	0 (0.00%)	1 (3.45%)	**13 (44.83%)**	7 (24.14%)	8 (27.59%)	29	3.76 / 5 (75.20%)
Ramps for ease of access through out the facility	2 (6.90%)	1 (3.45%)	10 (34.48%)	**11 (37.93%)**	5 (17.24%)	29	3.55 / 5 (71.00%)
Automatic doors with self closing and opening devices	1 (3.45%)	2 (6.90%)	**15 (51.72%)**	4 (13.79%)	7 (24.14%)	29	3.48 / 5 (69.60%)
Proper signage combining both text, colours, lighting and symbols for easy directions	2 (6.90%)	1 (3.45%)	**10 (34.48%)**	9 (31.03%)	7 (24.14%)	29	3.62 / 5 (72.40%)
Use of non slip floor finishes to prevent slips and falls	1 (3.45%)	3 (10.34%)	**10 (34.48%)**	6 (20.69%)	9 (31.03%)	29	3.66 / 5 (73.20%)
Provision of hand rails, stair lifts (where required)	0 (0.00%)	3 (10.34%)	**11 (37.93%)**	7 (24.14%)	8 (27.59%)	29	3.69 / 5 (73.80%)

and guard rails on stairs							
Adequate lighting along corridors and spaces	0 (0.00%)	0 (0.00%)	**11 (37.93%)**	7 (24.14%)	**11 (37.93%)**	29	4.00 / 5 (80.00%)
Outdoor areas for relaxation/informal activities	0 (0.00%)	7 (24.14%)	7 (24.14%)	**8 (27.59%)**	7 (24.14%)	29	3.52 / 5 (70.40%)
Disabled users fittings and facilities such as toilets, grab rails, adjustable furniture and IT equipment	0 (0.00%)	3 (10.34%)	8 (27.59%)	**11 (37.93%)**	7 (24.14%)	29	3.76 / 5 (75.20%)
							3.67 / 5 (73.42%)

17) As a user, was your opinion sought about the design of the teaching and learning environment provided during the design process or during the construction stage?

	Percentage	Responses
Yes	13.8%	4
No	86.2%	25
	Total responses:	**29**

18) The space design of the teaching and learning environment is technologically efficient because? Please select all that apply

	Percentage	Responses
The teaching and learning spaces were initially designed as a technology focused environment	19.6	10
The teaching and learning spaces were adapted into a technology supported teaching and learning environmemt	29.4	15
The teaching and learning spaces were upgrade with recent cutting edge technology features	19.6	10
The technology and equipment determined the space design of the teaching and learning environment	15.7	8
The users determine the space design and type of technology used within the teaching and learning environment	11.8	6
Other	3.9	2

19) Would you be interested in participating in a further interview?

Please note that you have a right to refuse participation or withdraw from this research at any time. Confidentiality of all information given is guaranteed and anonymity will be strictly adhered to in line with the 1998 confidentiality Act.

		Percentage	Responses
Yes		37.9%	11
No		62.1%	18
		Total responses:	**29**

Appendix E/2

Executive Survey Results for: A NOVEL METHODOLOGY FOR E-LEARNING SPACE DESIGN ON HEI CAMPUSES

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1) As an Executive of an HEI, have you been involved in the space design or construction projects within your Institution?

	Percentage	Responses
Yes	75.0%	3
No	25.0%	1
	Total responses:	**4**

---

2) What has been your role as an Executive in HEI with respect to the design of the teaching and learning spaces within your Institution. Please select all that apply

	Percentage	Responses
Client team-specifying breif and requirements	25.0	1
Space Design Initiator/facilitator of projects	25.0	1
Funding/Finance management	25.0	1
Head/Member of the Executive Committe overseeing all aspects of Space Design and Construction projects	0.0	0
Other	25.0	1
	Total responses:	**4**

---

3) Would you agree that Architecture has a significant part to play in the following, Please rate in order of significance where (1) is the lowest and (5) the highest

	1	**2**	**3**	**4**	**5**	**Responses**	**Average Score**
The strategic vision of the University	0 (0.00 %)	0 (0.00 %)	**2 (50.00 %)**	1 (25.00 %)	1 (25.00 %)	4	3.75 / 5 (75.00 %)
The educational system and phylosophy of the University	0 (0.00 %)	0 (0.00 %)	1 (25.00 %)	1 (25.00 %)	**2 (50.00 %)**	4	4.25 / 5 (85.00 %)
The level of technology uptake of the University	0 (0.00 %)	0 (0.00 %)	**2 (50.00 %)**	1 (25.00 %)	1 (25.00 %)	4	3.75 / 5 (75.00 %)
The culture of the staff and students of the University	0 (0.00	0 (0.00	0 (0.00%)	**2 (50.00**	**2 (50.00**	4	4.50 / 5 (90.00

	%)	%)		**%)**	**%)**		%)
The type of learning and teaching environment the university wishes to portray	0 (0.00 %)	0 (0.00 %)	0 (0.00%)	**2 (50.00 %)**	**2 (50.00 %)**	4	4.50 / 5 (90.00 %)
The recruitment and retention of students.	0 (0.00 %)	0 (0.00 %)	**2 (50.00 %)**	1 (25.00 %)	1 (25.00 %)	4	3.75 / 5 (75.00 %)
							4.08 / 5 (81.67 %)

4) What were the main factors for the design of the teaching and learning spaces within your university? please tick all that apply

	Percentage	Responses
It is part of the strategic vision of the University	23.5	4
The users' requirement led to the changes	11.8	2
The availability of funding	17.6	3
The recent and ever changing technological advancemet	17.6	3
The market competition for student retention	5.9	1
The desire for continued preservation and relevant in the academic world	0.0	0
Changes in the University's educational phylosophy e.g from tutor-led to student led studies	17.6	3
Other- the need for space to offer better services.	5.9	1

5) From JISC research, seven main teaching and learning space types within HEIs were identified. which of these do you feel the users of your teaching and learning spaces prefer or use the most? Please Rate where (1) is the lowest and (5) the highest

	1	**2**	**3**	**4**	**5**	**Responses**	**Average Score**
General teaching and Learning spaces	0 (0.00 %)	0 (0.00%)	**2 (50.00 %)**	1 (25.00 %)	1 (25.00 %)	4	3.75 / 5 (75.00 %)
Vocational/ Specialised Learning spaces	0 (0.00 %)	**3 (75.00 %)**	1 (25.00 %)	0 (0.00%)	0 (0.00%)	4	2.25 / 5 (45.00 %)
Social/ Blended Learning Spaces for informal studies	0 (0.00 %)	1 (25.00 %)	0 (0.00%)	1 (25.00 %)	**2 (50.00 %)**	4	4.00 / 5 (80.00 %)
Group teaching and Learning spaces	0	0	**3**	0	1	4	3.50 / 5

	(0.00%)	(0.00%)	**(75.00%)**	(0.00%)	(25.00%)		(70.00%)
Virtual/Immersive learning environments	0 (0.00%)	1 (25.00%)	**2 (50.00%)**	1 (25.00%)	0 (0.00%)	4	3.00 / 5 (60.00%)
Library/ Learning Centres	0 (0.00%)	1 (25.00%)	**2 (50.00%)**	0 (0.00%)	1 (25.00%)	4	3.25 / 5 (65.00%)
Outdoor Learning spaces	0 (0.00%)	**2 (50.00%)**	1 (25.00%)	1 (25.00%)	0 (0.00%)	4	2.75 / 5 (55.00%)
							3.21 / 5 (64.29%)

6) We would like to thank you for taking time to complete this survey. your contribution is highly appreciated.
If you would be interested in the outcome of this survey and the research findings, or should you wish to participate in a further interview please kindly fill in your contact details or e-mail.

Appendix E/3

Designers Survey Results for: A NOVEL METHODOLOGY FOR E-LEARNING SPACE DESIGN ON HEI CAMPUSES.

1) **General Questions**
What project group do you belong to? (please tick as appropriate)

		Percentage	Responses
Design team		100.0	4
Construction team		0.0	0
Client team		0.0	0
Building Services Team		0.0	0
Other		0.0	0
Total responses:			**4**

2) Please choose University Building Construction type

		Percentage	Responses
New Build		75.0	3
Rennovations		25.0	1
Other		0.0	0
Other		0.0	0
Total responses:			**4**

3) How many years of experience do you have in the construction of University Buildings

	Less than 2	**2 – 5**	**6 – 10**	**10 – 15**	**15 – 20**	**20 and Above**	**Responses**	**Average Score**
	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	0 (0.00%)	1 (25.00%)	1 (25.00%)	4	4.25 / 6 (70.83%)
								4.25 / 6 (70.83%)

4) On the average how many weeks did you spend on the design of the project? Please select what applies

		Percentage	Responses
4-8weeks		0.0	0
8-16weeks		50.0	2
16-24weeks		0.0	0
24-32weeks		0.0	0

32-40weeks		0.0	0
40-weeks and above		25.0	1
Other		25.0	1
Total responses:			**4**

5) On the average how many weeks did you spend on the construction stage of the project? Please state duration below

(The last five responses are given)

- **40 weeks and above**
- **15 weeks**
- **12 months**
- **10**

6) On the average how many weeks did you spend on the finishing and fitout stage of the project? Please state duration below

(The last five responses are given)

- **none**
- **6-8 weeks**
- **2 / 3 months**
- **10**

7) Did you take part in any CPD training? Please specify below

(The last five responses are given)

- **yes**
- **CDM construction course (Construction Design Management)**
- **cpd /ongoing attended lectures and seminars for Planning,Building Regulations,Bream,Current School Design ect.**
- **Primavera Software**

8) Would you consider yourself as having any form of disability or medical condition requiring additional support?

		Percentage	Responses
Yes		0.0%	0
No		100.0%	4
Total responses:			**4**

9) **Questions on the Use of E-Learning Facilities**
Please grade in order of priority where (1) is the lowest and (5) is the highest

The teaching and learning facilities you worked on were aimed at providing:-

	1	2	3	4	5	Responses	Average Score	
Spaces for users' to participate in collaborative teaching & learning	0 (0.00%)	0 (0.00%)	0 (0.00%)	**3 (75.00%)**	1 (25.00%)	4	4.25 / 5 (85.00%)	
Spaces for users' check emails and surf the web	1 (25.00%)	1 (25.00%)	0 (0.00%)	**2 (50.00%)**	0 (0.00%)	4	2.75 / 5 (55.00%)	
Spaces for users' to undertake quiet study	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	1 (25.00%)	1 (25.00%)	4	3.75 / 5 (75.00%)	
Spaces for users' to participate in tutorials and practical training sessions	0 (0.00%)	0 (0.00%)	0 (0.00%)	**3 (75.00%)**	1 (25.00%)	4	4.25 / 5 (85.00%)	
Spaces for users' to access online teaching and studying materials	0 (0.00%)	**1 (25.00%)**	**1 (25.00%)**	**1 (25.00%)**	**1 (25.00%)**	4	3.50 / 5 (70.00%)	
Spaces for users' to carry out presentations	0 (0.00%)	0 (0.00%)	1 (25.00%)	1 (25.00%)	**2 (50.00%)**	4	4.25 / 5 (85.00%)	
Spaces for users' to conduct research work, analysis or experiments	0 (0.00%)	1 (25.00%)	0 (0.00%)	**2 (50.00%)**	1 (25.00%)	4	3.75 / 5 (75.00%)	**3.79 / 5 (75.71%)**

10) Did you take part in providing any form of trainning for the users' of the teaching and learning facilities provided before handing over the facility?

	Percentage	Responses
Yes	25.0%	1
No	75.0%	3
Total responses:		**4**

11) **Space Design Questions**

Which of the following do you understand by the term 'an e-learning space' or 'a technology supported learning environment'? Please select all that apply

	Percentage	Responses
A space that incorporates social activities with informal learning facilities like a cyber café for blended learning	23.1	3
A space that has been fitted with IT facilities, digital technology and media for teaching & learning only	15.4	2
A space that has been fitted with technology supported learning facilities with inclusive design consideration for ease of accessibility and usage by all	23.1	3
A space fitted with flexible furniture, IT and technology for multipurpose usage	30.8	4
Learning through online (virtual) facilities only e.g. long distance learning	7.7	1
Other	0.0	0

12) As a designer or person involved in the construction of University Buildings, what in your opinion was the most important design consideration for the overall space design of the teaching and learning facilities project you worked on, Please rate where (1) is lowest and (4) highest

	1 least important	**2 fairly important**	**3 quite important**	**4 very important**	**5 extreamly important**	**Responses**	**Average Score**
Functionality	0 (0.00%)	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	**2 (50.00%)**	4	4.50 / 5 (90.00%)
Aesthetic quality	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	1 (25.00%)	1 (25.00%)	4	3.75 / 5 (75.00%)

Innovative use of space	0 (0.00%)	0 (0.00%)	0 (0.00%)	**3 (75.00%)**	1 (25.00%)	4	4.25 / 5 (85.00%)
Users' requiurement	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (25.00%)	**3 (75.00%)**	4	4.75 / 5 (95.00%)
							4.31 / 5 (86.25%)

13) Which of these space design solutions do you feel most effectively supports good teaching and learning requirement within an institution? Please select all that apply

	Percentage	Responses
Open space plan arrangement i.e. no walls	16.7	2
Enclosed space plans (i.e. with walls or glass partitioned areas)	25.0	3
Flexible furniture arrangement to allow for multipurpose use	25.0	3
Enclosed spaces without glass partitioned areas preferably opaque walls	8.3	1
Spaces fitted with good lightening, ventilation and acoustics to absorb sound during collaborative learning	16.7	2
Fixed furniture arrangement to allow for formal teaching and learning	0.0	0
None of the above (e.g. virtual/online study spaces)	0.0	0
Other	8.3	1

14) **Questions on the Impact of Space Design on Teaching and Learning**

Do you think that the space design of the teaching and learning environment provided could generally improve users' teaching and learning experience, please tick where (1) strongly agree and (4) strongly disagree

1 Strongly agree	**2 Agree**	**3 Disagree**	**4 Strongly disagree**	**Responses**	**Average Score**
3 (75.00%)	1 (25.00%)	0 (0.00%)	0 (0.00%)	4	1.25 / 4 (31.25%)
					1.25 / 4 (31.25%)

15) What aspects in your opinion may impact significantly on an

institution's teaching and learning facilities for users' studying or working? Please grade in order of significance where (1) is the lowest and (5) is the highest

	1	2	3	4	5	Responses	Average Score
The location and design of the stairs and lifts	0 (0.00%)	0 (0.00%)	**4 (100.00%)**	0 (0.00%)	0 (0.00%)	4	3.00 / 5 (60.00%)
The acoustics (Sound/noise control levels)	0 (0.00%)	0 (0.00%)	1 (25.00%)	1 (25.00%)	**2 (50.00%)**	4	4.25 / 5 (85.00%)
The furniture type and their arrangement	0 (0.00%)	0 (0.00%)	0 (0.00%)	**3 (75.00%)**	1 (25.00%)	4	4.25 / 5 (85.00%)
The space design and layout (flexible, adaptable & multifunctional spaces)	0 (0.00%)	0 (0.00%)	0 (0.00%)	**3 (75.00%)**	1 (25.00%)	4	4.25 / 5 (85.00%)
The location of all fittings & services e.g., IT, Toilets, Stairs, Lifts, Vending Machine etc.	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	1 (25.00%)	1 (25.00%)	4	3.75 / 5 (75.00%)
Circulation design (how people access the building and move about)	0 (0.00%)	0 (0.00%)	0 (0.00%)	**4 (100.00%)**	0 (0.00%)	4	4.00 / 5 (80.00%)
The ventilation design	0 (0.00%)	0 (0.00%)	1 (25.00%)	**3 (75.00%)**	0 (0.00%)	4	3.75 / 5 (75.00%)
The lighting levels (natural/artificial)	0 (0.00%)	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	**2 (50.00%)**	4	4.50 / 5 (90.00%)
							3.97 / 5 (79.38%)

16) Do you feel that the space design of the teaching and learning environment provided would be suitable for users' requirements? Please tick where (1) is very suitable and (4) is very unsuitable.

1 very suitable	2 fairly suitable	3 unsuitable	4 very unsuitable	Responses	Average Score
1 (25.00%)	**3 (75.00%)**	0 (0.00%)	0 (0.00%)	4	1.75 / 4 (43.75%)
					1.75 / 4

(43.75%)

17) Some inclusive design considerations within the space design of the teaching and learning environment are listed below. Please grade them according to your opinion of their relevance within the institution where (1) is the lowest and (5) the highest

	1	**2**	**3**	**4**	**5**	**Responses**	**Average Score**
Wide corridors and doors for wheel chair users	0 (0.00%)	0 (0.00%)	1 (25.00%)	**2 (50.00%)**	1 (25.00%)	4	4.00 / 5 (80.00%)
Ramps for ease of access through out the facility	0 (0.00%)	0 (0.00%)	1 (25.00%)	**2 (50.00%)**	1 (25.00%)	4	4.00 / 5 (80.00%)
Automatic doors with self closing and opening devices	0 (0.00%)	**1 (25.00%)**	**1 (25.00%)**	**1 (25.00%)**	**1 (25.00%)**	4	3.50 / 5 (70.00%)
Proper signage combining both text, colours, lighting and symbols for easy directions	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	1 (25.00%)	1 (25.00%)	4	3.75 / 5 (75.00%)
Use of non slip floor finishes to prevent slips and falls	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	1 (25.00%)	1 (25.00%)	4	3.75 / 5 (75.00%)
Provision of hand rails, stair lifts (where required) and guard rails on stairs	0 (0.00%)	0 (0.00%)	1 (25.00%)	**2 (50.00%)**	1 (25.00%)	4	4.00 / 5 (80.00%)
Adequate lighting along corridors and spaces	0 (0.00%)	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	**2 (50.00%)**	4	4.50 / 5 (90.00%)
Outdoor areas for relaxation/informal activities	0 (0.00%)	0 (0.00%)	1 (25.00%)	**3 (75.00%)**	0 (0.00%)	4	3.75 / 5 (75.00%)
Disabled users fittings and facilities such as toilets, grab rails, adjustable furniture and IT equipment	0 (0.00%)	0 (0.00%)	0 (0.00%)	**2 (50.00%)**	**2 (50.00%)**	4	4.50 / 5 (90.00%)
							3.97 / 5 (79.44%)

18) Did you seek the opinion or input of users about the design of the teaching

and learning environment provided during the design process or during the construction stage?

		Percentage	Responses
Yes		100.0%	4
No		0.0%	0
Total responses:			**4**

19) Would you agree that the space design of the teaching and learning environment provided is technologically efficient? Please select all that apply

		Percentage	Responses
The teaching and learning spaces were initially designed as a technology focused environment		12.5	1
The teaching and learning spaces were adapted into a technology supported teaching and learning environmemt		25.0	2
The teaching and learning spaces were upgrade with recent cutting edge technology features		0.0	0
The technology and equipment determined the space design of the teaching and learning environment		37.5	3
The users determine the space design and type of technology used within the teaching and learning environment		25.0	2
Other		0.0	0

20) If you would be interested in participating in a further interview or if you would like to know the outcome of this research, please fill in your contact and e-mail below.

Please note that you have a right to refuse participation or withdraw from this research at any time. Confidentiality of all information given is guaranteed and anonymity will be strictly adhered to in line with the 1998 confidentiality Act.

(The last five responses are given)

Key to interpreting the data.

- True/Yes = 1
- False/No = 2
- Answers to Multiple Choice questions are given in numeric form reflecting the order in which they appear, counted top to bottom.
- Answers to Matrix questions are given as the column number counting from left to right.
- No answer: 0 or blank cell on spread sheet.

- 999999 = respondent selected the "other" option but did not specify a full answer.

Appendix F-

Case studies of 21st Century Learning and Teaching.

Case Study 1- Changing culture – Edinburgh's Telford College:

A new-build project in 2006 enabled a further education college to move into a high-specification campus. With a reduction in overall space, changes were needed to the way staff and students had been working. In the video, a senior manager described the change process

Case Study 2- a social and collaborative learning space – the Saltire Centre, Glasgow Caledonian University:

The Saltire Centre at Glasgow Caledonian University, a 10,500 sq m innovative learning space at the centre of the campus, provides 1800 study places and a one-stop structure for all student services. Students see the Centre as their space – its selling point was its flexibility to different user requirements.

Case Study 3- A technology-rich space for inquiry-based learning – CILASS, University of Sheffield:

CILASS – a Centre for Excellence in Teaching and Learning (CETL) in inquiry-based learning in the arts and social sciences at the University of Sheffield – was using refurbished space in a Victorian building to explore the potential of new technology in student-led inquiry-based learning. In the video, the Pro Vice-Chancellor, CILASS director, audio-visual manager, academic staff and students talk about what the space and its innovative technologies meant to them.

Case Study 4- A technology-rich science centre – London Metropolitan University:

The new Science Centre at London Metropolitan University combined community resources – for example a sports hall – with a multi-purpose laboratory containing 268 student workstations, with its own computer each. The space was equipped with audio facilities to allow more than one group of students and subject discipline to be taught concurrently, 'making the Super Lab the most flexible space of its kind' In the video, academic staff and students explained how this works.

Case Study 5- A campus for the 21st century – City Campus, University of Wolverhampton:

The Pro Vice-Chancellor and Director of IT Services at the University of Wolverhampton described the long-term idea behind the redevelopment of the City Campus and described how various sorts of learning spaces had been developed to go with different learning goals, thereby enabling the university meet the expectations and changing needs of the learner.

Watson, et-al (2007) argued that due to the notable recent investments in estates development, there was a need for resources that would provide instruction on how technology could be effectively integrated into the design of learning spaces in order to 'add value to institutional provision and thereby enhance the learner experience. A view expressed by HEFCE (2005) and an underlying factor for this on-going research as well.

The report claimed that frequently, the potential for technology was misunderstood, and that this led to 'designs that reflect patterns of usage from a pre-digital age, or encountered difficulties in practice; and that JISC material had been assisting to discover a 'synergy' between ambitions for 'innovative 21st-century learning and teaching and physical space designs that could motivate learners and teachers and function effectively.'

The report reiterated also that similar research by JISC into the 'learner's perspective on e-learning' indicated a 'widespread use of personal technologies on as well as off campus and a growing requirement for spaces that facilitate collaborative and social learning'. The report asserted that this finding was an indication of how learning spaces might evolve during the next decade', with respect to the future of learning spaces in Higher Education. In addition, it stated that JISC studies shows how learners were seeking greater control over the technologies they use', 'blending informal and institutional technologies in ways that support their individual needs'.

Future Implications:

The report stated that 'It was JISC's view that the physical campus will remain at the core of educational provision for the foreseeable future, but that many spaces will not look or function as they have done in the past – nor should they. As understanding increases of the different ways by which people learn in a digital age, so physical space design in educational institutions will continue to evolve'. This is almost in contrast to Pierce, (2001) assertion that the future of the higher education institutions would be the virtual campus

The report submitted that it was therefore the intention of JISC to 'continue to monitor the close relationship between physical space, pedagogy and technology to ensure that the design, implementation and evaluation of technology-rich spaces is supported by clear sighted examination of the issues, with case studies and guidelines for those involved'.