Designing an Information Infrastructure to Support Research Degree Programmes: Identifying Information and Technology Needs

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Abstract

Extensive previous research has shown that web-based technologies have the potential to improve and enhance the quality of learning both on campus and at a distance. However, most of these studies have focused on the application of web-based technologies to support either undergraduates or taught postgraduate programmes, particularly, the use of Virtual Learning Environment (VLE) system to complement module-based courses. Evidence from previous research on the use of VLE to support research students in the context of specific modules showed mixed results. Analysis of the VLE literature suggests that the system arranges courses based on academic calendar. Thus, students will not be able to access the system after the semester end. With postgraduate research, the processes of research are often incomplete even when students have graduated and they often seek to further the work through publication in journals. Therefore, using VLE alone would not possibly support the need of research student, particularly the support that they need throughout the stages of the research life cycle. Therefore, the main aim of this study is to investigate how a web portal could be designed to support the research students throughout the research life cycle.

A conceptualised web portal design has been constructed through an extensive review of the web-based technologies, learning theories and research degrees literature. The conceptualised web portal design illustrates that the design is underpinned by adult learning theories and the theory of stages in socialisation development, which in turn inform the framework of this research study. This model was then validated and updated through four action research cycles. A web portal system was developed, using the prototyping method to demonstrate the application of the web portal design informed by the adult learning theories and theory of stages in socialisation development.

The research findings suggest that action research and prototyping methodology is capable of designing a web portal that is able to support the needs of research students in the context of a life cycle approach. Furthermore, the study reveals that personalisation and customisation features have proved to be useful in providing relevant information to research students at each stage of the research students' study. It was found that research students value dynamic content such as Really Simple Syndication (RSS) features for providing condensed, updated content relevant to their interests.

Dedication

This thesis is dedicated to my husband, Najmy and my daughters, Najihah and Nabilah for their prayers, unconditional love, support and understanding over the years.

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Chapter 1. Introduction

This thesis reports on the production of an information infrastructure – in the form of a web based portal - and examines the experience of the portal development, in particular the identification of information resources and technologies support for postgraduate research students. The inquiry draws on a two-year action research cycles that started in February 2007 to develop and test a web portal design model for postgraduate research students' support.

The areas of interest of the thesis are depicted in Figure 1 and marked with a red rectangle. Within the web-based applications domain, the research is interested in designing a web portal. The web portal was designed using a participatory approach of the information system development methodologies – prototyping. Current researches have been primarily invested in exploring the use of web-based technologies to support undergraduate students (De Leng *et al.*, 2006; Mogus *et al.*, 2012; Limniou and Smith, 2014). However, it was argued that the needs of postgraduate research students toward an online information provision are regarded as different from undergraduate students (Ramrattan, 2010). Therefore, this study focuses on understanding of how to provide information and technologies support for postgraduate research students that consequently met the needs of these students. The research employed action research methodology to explores and understand the process of designing a web portal that could provide appropriate support to postgraduate research students throughout the stages of their life cycle.

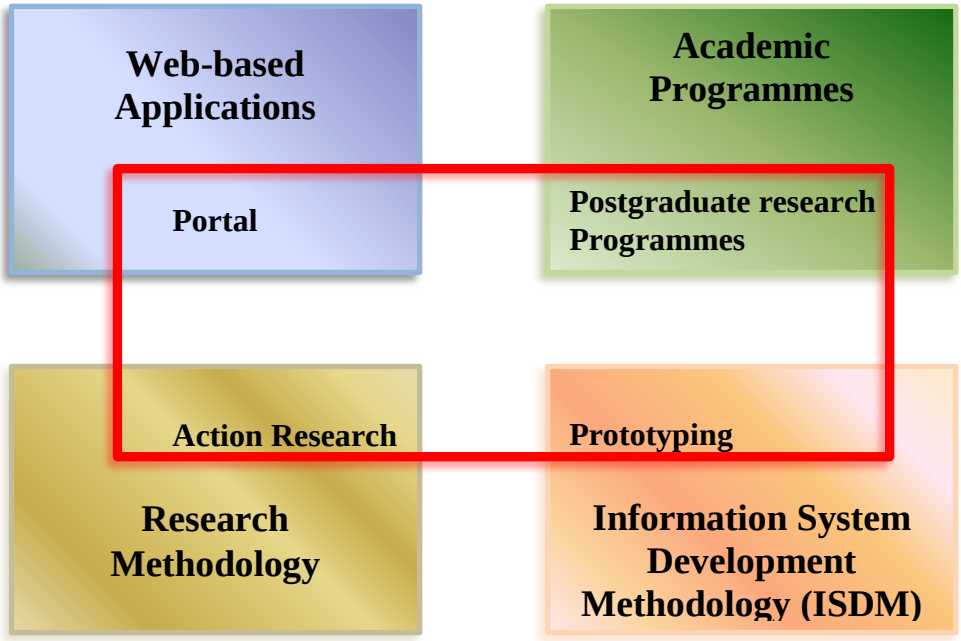


Figure 1 – Proposed research area

1.1 Research Problem

In the last decade, there has been a steady and substantial growth in e-learning and its use throughout higher education (HE) institutions in the United Kingdom. For instance, in 2005, a survey into technology enhanced learning (TEL) within UK universities reported that 95% of the HE institutions surveyed used virtual learning environment (VLE) – a particular form of e-learning system (Jenkins *et al.*, 2005). In terms of VLE usage by students and staff, 66% of HE institutions surveyed reported that more than 3000 students were registered as VLE users, whilst 49% of the HE institutions surveyed reported that more than 200 staff were registered as VLE users (Jenkins *et al.*, 2005). In addition to the UK HE institutions, the widespread adoption of VLEs has also penetrated other parts of the world. For example, about 80% of European universities and colleges (Valcke, 2004) and 95% of the US learning institutions use a VLE (Lonn and Teasley, 2009).

Along with the proliferation of e-learning in higher education, many researchers have investigated how these web-based technologies have supported learning. Particularly, the use of VLEs to support the undergraduate process of teaching and learning in higher education institutions worldwide (Casany *et al.*, 2012). Previous researchers argue that VLEs have been successful in delivering content (Gibbs and Gosper, 2006) and supporting management of courses and student accounts (Mott, 2010). However, the VLEs typically arrange courses based on academic calendar where access to the system ceases when the course finishes

(Mott, 2010). Consequently, this could affect the continuity of the overall learning process. Other limitations of VLEs include its inflexibility in terms of supporting student-initiated learning activities and content sharing across courses.

With postgraduate research, the processes of research are often incomplete even when students have graduated and they often seek to further the work through publication in journals. Therefore, using VLE alone would not possibly support the need of research student, particularly the support that they need throughout the stages of the research life cycle. Furthermore, evidence from previous research on the use of web-based technologies to support research students in the context of specific modules showed mixed results (Lim *et al.*, 2008; Meyer, 2010; Rockinson-Szapkiw, 2011). Further analysis suggests that this may be because module-based approaches were used, rather than considering an approach that was embedded across the whole research programme. This critical analysis suggests that an alternative approach to providing information provision that consider the support throughout the stages of the research life cycle of research students should be investigated. Therefore, the main aim of this study is to investigate how a web portal could be designed to support the research students throughout the research life cycle.

1.2 Research Questions

The main research question to be addressed by this study will be to find out how to design an information infrastructure that provides appropriate resources within the context of research students' subject discipline throughout the stages of research life cycle. The specific research questions are as follows:

1. How to design a web portal that could provide support throughout the stages of research students' life cycle?
2. What are the benefits and challenges of undertaking a participatory approach in designing a web portal for postgraduate research students?
3. What are the lesson learned in the design and development of a web portal that provide support throughout the stages of research students' life cycle?

1.3 Research Objectives

1. To propose a web portal design that may help higher education institutions to provide information provision to postgraduate research students.

2. To study the benefits and challenges of employing participatory approach particularly prototyping methodology to design information provision for postgraduate research students.
3. To contribute lessons learned and observations in designing a web portal for postgraduate research students.

1.4 Significance of the Research

The significance of this study lies primarily in its focus on the research process of research students. Investigating the information and technology needs of research students is the key to understanding their information requirements for the main tasks involved, in order to make realistic progress in their research. The focus of this study has the potential to provide an in-depth understanding of how these students undertake postgraduate research from their own perspective. This has significant implications for finding ways to improve the information and technological provision required by research students.

Second, this study pioneers a systematic investigation of how a web portal can be designed to support students in the research-learning context. Its findings will provide fresh insights for the literature on online provision. Furthermore, it introduces a new perspective on the study of designing a generic web portal that integrates support systems within HE institutions, which has been dominated by the investigation into e-learning applications for undergraduate and taught postgraduate education.

1.5 Motivation and Scope of the Research

Prior to attending the postgraduate research at Newcastle University, the researcher is a lecturer at one Malaysian public university. She involves in both teaching and conducting research. However, her research experience is mainly in the quantitative-based approach to research. She has involved in developing questionnaires, conducting surveys and performing some quantitative analysis including SPSS statistical software. However, the 'research' conducted is comparable with a Master research project, rather than a doctoral research. This is due to the level of the contribution to knowledge is relatively lower compared to PhD research. Hence, the researcher commences her doctoral study with little knowledge and experience of qualitative-based approach as well as the process of the doctoral research. The modules relating to qualitative approaches undertaken during the research training program in her first and second year of the postgraduate study have greatly contributed to her

understanding of the qualitative approaches to research.

As a novice researcher – in terms of her experience in conducting academic research – she faced difficulty in terms of starting her research – how and where to start. In addition, being a married Asian woman studying in the UK, present some challenges in terms of adapting to different culture and approach to learning. Based on this experience, she felt that she needed to explore how to improve the experience of research students, particularly those who came with little research experience. With action research, she is able to be involved in identifying and evaluating possible solutions. In addition, she is also able to put those solutions into practice and study the effect of her intervention. This is the main reason that motivates her to apply action research in her research. Furthermore, action research allows the researcher to be involved in the research process, not just as a distant observer.

The researcher's role in the study varies from mediator, developer and researcher. It involves various levels of collaboration with postgraduate research students and the web team. First, she acted as an intermediary between the students and the technical team. This role was advantageous to the researcher, since she was a research student, and this gave her the advantage that she understood the needs of the people like her and could communicate these needs to the technical team. Second, the researcher acted as the developer of the prototype portal. She learnt how to develop web applications using software development product such as Macromedia Dreamweaver and Macromedia Flash. She also learnt JavaScript (Flanagan, 2001), a scripting language suitable for web application development.

The web portal project originated from a grant obtained by one of the supervisors. The grant was part of the Newcastle University's e-services project. Baida at el (2005, p. 400) defined e-services as "a web-based version of traditional services, defined as business activities, deeds, and performances of a mostly intangible nature". The University e-services project aimed to develop integrated student services that included developing online forms, payments and bookings (Alexander, 2007, p. 3).
Potential stakeholders in this study include:

1. The graduate schools (the Faculty of Humanities and Social Sciences (HASS); the Faculty of Medical Sciences and the Faculty of Science, Agriculture and Engineering (SAgE)) interested in the effective way of providing information and technological support to postgraduate research students;

2. The directors of postgraduate research training;
3. The librarian personnel involved in providing information resources support to postgraduate research students;
4. Supervisors;
5. Postgraduate research students.

1.6 Definition of Terms

1.6.1 *Information infrastructure*

This thesis focuses on the design of a web portal that aims to provide an adequate information infrastructure through which postgraduate research students could rely upon for their information resources' need. Therefore, in this section, the thesis explores the definition of the term 'information infrastructure'. Generally, the term 'infrastructure' covers the basic physical facilities such as buildings, roads, ports and communication network that enable an organization or society to function (Hanseth *et al.*, 1996; Jessup and Valacich, 2007). However, Bowker (2010, p. 98) extend this general definition of infrastructure to include:

a) technologies and organisations which enable knowledge work - supercolliders, orbiting telescopes, supercomputer centres, polar research stations, national laboratories and other research instruments of 'big' science;
b) scientific organisations – funding agencies, professional societies, libraries and databases …;
c) … and the individuals – designers and developers, users and mediators, managers and administrators.

In the digital environment, the word 'infrastructure' refers to the concept of socio-technical systems. According to this concept, the social and technical are inextricably intertwined. Thus, infrastructure is formed as a result of interaction of artefacts and technologies with organisational and social practices (Chris Jones, 2008). Accordingly, Hanseth and Lundberg (2001, p. 349) characterized an information infrastructure as

> Infrastructures are *shared resources* for a community; the different components of an infrastructure are integrated through *standardized* interfaces; they are *open* in the sense that there is no strict limit between what is included in the infrastructure and what is not, and who can use it and for which purpose or function; and they are

heterogeneous, consisting of different kinds of components – human as well as technological.

The definition of information infrastructure given by Hanseth and Lundberg (2001) is sufficient and therefore is adopted in this thesis.

1.6.2 *E-learning*

There are many definitions of the term 'e-learning', and it is often used synonymously with the terms 'online learning' (Darking, 2004), 'web-based learning' (Webster and Hackley, 1997) and 'technology mediated learning' (Alavi and Leidner, 2001). The differences between these definitions are often subtle, and serve the particular aims of the definer. However, for the purposes of consistency, the term "e-learning" will be used in this thesis.

Definitions of e-learning can be very broad, for example, the Department for Education and Skills has defined e-learning as "learning in a way that uses information and communication technologies" (Department for Education and Skills, 2003, p.4). This definition may cover a wide range of activities, from accessing lecture notes on the Internet, communicating with peers and instructors through e-mail, or participating in interactive educational television programmes.

Alavi and Leidner (2001, p. 2) prefer the term 'technology-mediated learning', and have defined it as "an environment in which the learner's interactions with learning materials (readings, assignments, exercises), peers, and/or instructors are mediated through advanced information technologies". They further define those information technologies in terms of computing, communication, data management technologies, and their convergence. This definition is attractive, since it clearly articulates the meaning of learning and implies that it can be achieved when learners interact with learning materials, peers and/or instructors.

Other authors define e-learning based on levels of technology use and dependence. For example, Oliver (2005) proposed three common forms of e-learning, to include:

- Flexible learning – technology supports for learning anytime and anywhere;
- Blended learning - varying mixes of technology and traditional learning in conventional settings; and
- Online learning – where technology provides the means for the implementation and delivery of learning programmes totally distinct from face-to-face teaching.

Oliver's definition of e-learning is consistent with Procter's e-learning spectrum (Procter, 2002), where different terms are used to distinguish the proportion of electronic delivery. This is shown in figure 2.

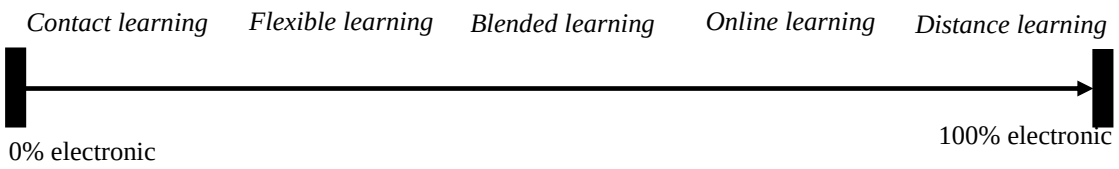


Figure 2 - Spectrum of E-Learning adapted after (Procter, 2002)

According to Procter (2002), a module that includes e-learning may fall anywhere on the continuum in figure 2. Even though figure 2 indicates that contact learning has zero percent and distance learning has 100 percent of electronic delivery, Procter (2002) recognised that in practice it was not that rigid. For instance, a module which is described as 'contact learning' may include some elements of distance learning by electronic means, and a module which is described as 'distance learning' may include some face to face contact such as induction courses.

Figure 2 also suggests that blended learning is positioned somewhere within the e-learning continuum. The blended learning perspective is adopted in this thesis. However, the concept of e-learning that this thesis refers to is slightly different from that of Procter's and Oliver's. In this thesis, e-learning refers to the use of web-based technologies to support learning. The implementation of web-based technologies not only aims at complementing physical campus education, but also facilitating distance learning. This definition will be developed further as more discussion takes place.

Figure 3 provides a graphical representation of how this thesis views e-learning in relation to campus learning and distance learning.

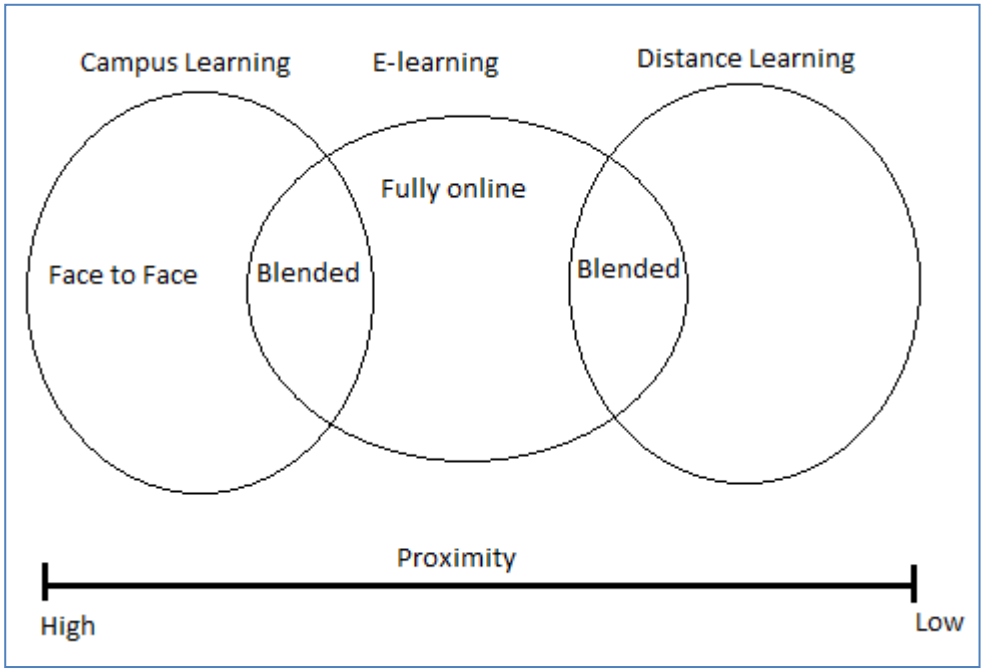


Figure 3 – E-learning

Contrary to Procter's and Oliver's view that distance learning is a form of e-learning, this thesis takes the viewpoint that e-learning has different characteristics to some extent from distance learning. Guri-Rosenblit (2005) argued that there are three distinct differences between distance education and e-learning. Firstly, distance education and e-learning differ in terms of remoteness and proximity (see figure 3). The term distance education, by its very definition, denotes the physical separation of the learner from the instructor (Guri-Rosenblit, 2005). However, pure distance education rarely exists in practice. In contrast, 'distance' is not the defining characteristic of e-learning. However, the use of web-based technologies in e-learning not only facilitates campus learning but also distance education. These situations are indicated by the overlapping areas between campus learning and e-learning bubbles and e-learning and distance learning bubbles in figure 3. In terms of level of physical proximity between students and instructors, campus learning is considered to be higher than that of distance learning.

Secondly, distance education and e-learning differ in terms of their target clientele. For instance, distance education focuses its offering on special clienteles such as learners who cannot attend a conventional campus for a variety of reasons. However, e-learning services are not targeted solely at distance learners, but cover all types of student at all educational levels.

Thirdly, Guri-Rosenbilt (2005) argued that distance education and e-learning differ in terms of production and delivery costs. It was claimed that distance education has been able to broaden access to higher education by providing economies of scale. This is achieved as the cost of self-study materials per student decreases and as the number of students increases. Despite its benefits, many authors (Fielden, 2002; Ryan, 2002; Bates, 2005) have argued that effective e-learning costs more than conventional face-to-face teaching.

As for campus learning, there are two types of educational methods: face-to-face and blended learning. Face-to-face method means that the learning process is delivered without the aid of web-based technologies. The overlapping area between campus learning and e-learning in figure 3 indicates the blend of web-based technologies and face-to-face methods to support the learning process.

Hence, this thesis views e-learning as covering not only fully online learning but also blended learning. The fully online learning method refers to using only web-based technologies to deliver learning. The concept of fully online learning assumes that face-to-face interaction may be simulated through the effective use of web-based technologies that allow synchronous voice communication (Groen and Qing, 2005). The focus of this research is on the intersect areas of figure 3, which is the blended part. In this study, the assumption is that blended learning comprises the use of web-based applications alongside traditional methods of providing supervision and research training to support research learning. Specifically, this thesis looks at the requirements of research students toward a web-based application. The intention of this thesis is not only to support campus-based or distance learners but most importantly, to support throughout the full 'life cycle' of a research student – from an initial application through to graduation and throughout subsequent careers. As this research focuses on the application of a web-based system for the research programme which is the blended learning, the findings of this research may not be applicable to e-learning in general. However, the findings of this research extend the e-learning literature by providing knowledge on how a web-based application has been effectively applied in the research programme domain.

1.6.3 *Open and closed learning*

The term 'open' learning has been used to refer to distance learning (Teshome, 1992; Hannafin *et al.*, 1999). However, this thesis adapted the definition of open and closed learning

given by Lewis (1986). According to Lewis (1986), the extent to which learning is considered 'open' or 'closed' depends upon two factors:

(a) the kind of choices given to learners; and

(b) the degree of choices allowed to learners.

Lewis (1986) argued that the openness or closeness of learning could be viewed as a continuum. According to this model, the openness of any learning scheme can be analysed according to nine basic questions: why learners learn; what learners learn; how learners learn; where learners learn; when learners learn; how their learning is measured; who can help them; what learners do next as well as what it leads to. For example, research degree study is very open on:

(a) Why learners learn (the choice to study lies with the individual);
(b) What learners learn (the learners negotiates research objectives with their supervisors);
(c) How learners learn (routes can be negotiated whether fully research or Integrated);
(d) Where learners learn (research space is usually allocated, however, learners choose where to study);
(e) When learners learn (the start date and pace are negotiable, however, the finish dates or duration may be fixed);
(f) How the learner do (progress is reviewed periodically by appointed committees); and
(g) Who can help the learners (support from supervisors and other sources e.g. research training programmes and e-learning resources).

However, it relatively closed on:

(a) Who can study (the target audiences are graduate students and experienced workers);
(b) How learning will be measured (in the UK performance is measured through a viva and a written thesis (Morley *et al.*, 2002)).

Therefore, the term 'open' and 'closed' learning used in this thesis refers to the above definition.

1.7 Organisation of the Thesis

Chapter two presents a critical review of the literature in two areas, current web-based applications and web-based applications within research education. It critically reviews issues and opportunities in using web-based applications to support research students throughout their research life cycle. The results of the review have led to the identification of gaps in the

literature that this thesis addresses.

Chapter three establishes the context on which this study focuses – the research degrees. First, this chapter draws on relevant theories related to adult learners as the basis for the development of the web portal. Second, it critically scrutinizes the differences between research degrees and taught programmes. The analysis of the research degree context indicates that different approaches to providing online support are essential in order for research students to obtain full benefits.

Chapter four is concerned with the research methodology used in this study. It starts with an investigation of various kinds of research strategies and designs that have been deployed to study different aspects of web-based applications. It then focuses on the analysis of data collection methods which have been used in the existing e-learning literature. Following the review, it justifies the action research approach, as well as specific techniques used to collect empirical data.

Chapter five focuses on the implementation of the research strategy in which the empirical work took place. Furthermore, it describes the process of data collection, using the instruments of focus groups and interviews. Chapter six provides the results and discussion of the research by drawing upon a rich description of the action research cycles. Chapter seven reflects on the conduct of this research, and summarises the contributions of this thesis, its limitations and possible directions for future research.

Chapter 2. Literature Review: Web Portal – A Generic Information Infrastructure

Chapter 1 established the research focus of the investigation in regards to the identification of information and technology needs in designing an information infrastructure to support research degree programmes. In section 2.1, discussion on the issues in web portal design and development is provided. The chapter continues by presenting an overview of web-based technologies in section 2.2. Here, the purpose is to reveal the types and functionalities of various web-based applications. Finally, section 2.3 discusses some web-based applications that have been employed in facilitating research studies. Building on these sections, the gaps in previous research in this field are identified and discussed.

2.1 Web Portal Design and Development

This thesis focuses on designing an information infrastructure – a web portal. In designing and developing a web portal or an information system, an information system development methodology (ISDM) is important. An ISDM could provide some structure for the process, could be used to promote organizational standards, and could allow designers and others to more easily document and communicate about the design (Russo and Graham, 1999). Furthermore, information system development (ISD) can be seen as a difficult task, thus professional and systematic approach to development is desirable. This section discusses what is the ISDM, the evolution of ISDM to understand the reason behind each iterations. Then, the focus of the thesis will shift to discussing relevant ISDM in more details. A framework for evaluating ISDM relevant to the project will be conducted. Based on this evaluation, one ISDM will be chosen and discussed in more detail.

2.1.1 *Information System Development Methodologies (ISDMs)*

There has been many attempts at defining information system development methodology (Vidgen *et al.*, 2002; Avison and Fitzgerald, 2006a; Huisman and Iivari, 2006; Hons, 2012). However, for the purpose of this thesis, only two most well-known definitions are included. The purpose here is to provide some perspectives on ISDM. According to Avison and Fitzgerald (2006a), the term methodology encapsulates more concepts than a method in which it includes a philosophical view. Therefore, Avison and Fitzgerald (2006a, p. 567) define ISDM as:

> a collection of procedures, techniques, tools and documentation aids which will help

the systems developers in their efforts to implement a new information system. A methodology will consist of phases, themselves consisting of sub-phases, which will guide the systems developers in their choice of the techniques that might be appropriate at each stage of the project and also help them plan, manage, control and evaluate information systems projects.

Considering the observation of Avison and Fitzgerald (2006a) on the inclusion of a philosophical view of ISDM, Huisman and Iivari (2006, p. 32) define an ISDM as consisting of four components as conceptualised in Figure 4:

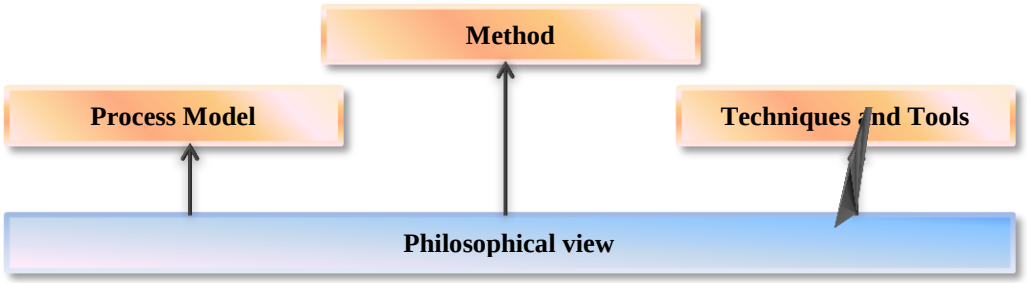


Figure 4 - Components of System Development Methodology

These components are briefly discussed below:

- Philosophical view: It is the underlying assumptions upon which the methodology is built. These comprise of a set of goals, guiding principles and beliefs, fundamental concepts, and principles of the system development process that drive interpretations and actions (Iivari *et al.*, 1998). Some examples include the structured, system, participative and contingency approaches (Avison and Fitzgerald, 2006a).
- Process model: It is the representation of the sequences of stages in the course of systems development. Examples are linear life-cycle and spiral models.
- Method: It is a systematic approach of developing a system, consisting of a set of guidelines, activities, techniques, and tools which are based on a particular philosophy and the target system (Wynekoop and Russo, 1993). Some of the examples include object modelling techniques (OMT) and information engineering (IE).
- Techniques and tools: Techniques are procedures followed during development activities while tools refer to mechanisms intended in helping to develop an information system. Examples are data-flow diagram, entity relationship diagram

and state transition diagram.

Despite the importance of an underlying philosophical basis to an ISDM as claimed by these authors, it is noted that this is not a universally accepted view. For example, several studies on the application of ISDMs in practice have found that developers tend to adapt instead of adopting a methodology (Brian Fitzgerald, 1998; Carroll, 2003; Burns and Deek, 2011; Hons, 2012; Barrow, 2013). This process of tailoring a methodology could possibly undermine the practical effects of the application of underlying philosophy (Barrow *et al.*, 2007). For the purpose of this thesis, the definitions of ISDM given by both Avison and Fitzgerald (2006a) and Huisman and Iivari (2006) are sufficient and thus are adopted in this thesis.

In order to appreciate the current state of ISDM, it is essential to be informed of their origin and the reasons behind their emergence. Avison and Fitzgerald (2006b) identify four methodology eras namely pre-methodology, early methodology, methodology and post-methodology. A summarised version of their works is provided as follows.

Pre-methodology Era

In the beginning of this era, computer applications were developed without an explicit ISD methodology. The development of applications were mainly focused on programming and solving technical problems such as exploiting restricted amount of memory. Furthermore, developers were technically trained but lack communications skills. Hence, this led to poor understanding of users' requirement that resulted in inappropriate design of applications. Developers primarily used their experiences and rule-of-thumb to develop applications. This informal 'methodology' often led to poor control and management of projects. It is argued that because of these problems, the first ISD methodologies were established to appreciate the desirability of standards and formality (Avison and Fitzgerald, 2006b). The characteristics of this era can be summarised in Table 1.

Types	Characteristics	Consequences
Approach to development	Rule-of-thumb and developers' experiences	Poor control and management of projects
Focus of development	Programming, overcoming limitation of technology	Inappropriate design – do not meet application needs
Skills	Technical	
Lack of skills	Understanding users' requirement, Communication skills	

Table 1 – Characteristics of pre-methodology era

Early Methodology Era

Avison and Fitzgerald (2006b) argue that the problems faced in the pre-methodology era has influenced the construction and evolution of System Development Life Cycle (SDLC) or the Waterfall model in the early methodology era which was reckoned to be between the late 1970s and early 1980s. The SDLC consisted of phases, procedures, tasks, rules, techniques, guidelines, documentation, training programs and tools. Typical SDLC phases include feasibility study, systems investigation, analysis, design, implementation, review and maintenance. These phases were expected to be followed sequentially. The documented advantages of SDLC include manageable tasks through the division of development process into phases, well-formed and standard training scheme and benefits from proper documentation standard. Despite its advantages, the SDLC approach suffers serious criticisms. Some potential limitations are not meeting the real needs of a business, instability, inflexibility, offering no user satisfaction and an extensive generation of documentation.

Methodology Era

The methodology era began when several different approaches to ISD emerged as a response to address limitations and criticisms of SDLC. One approach concerned with developing techniques and tools to improve upon the Waterfall model such as entity relationship modelling, normalisation and structured English. A second approach proposed new methodologies that were somewhat different to traditional Waterfall model and can be placed under different categories of ISDM such as structured, data-oriented, prototyping and object-oriented categories or a combination of them. However, these alternative approaches also suffered criticisms from the ISD users' community. It was argued that most of these methodologies were designed for a stated or unstated ideal type situation but in practice, situation like this rarely exists (Avison and Fitzgerald, 2006b, p. 32). Consequently, a contingency approach to ISD was proposed. This approach provided structures, but

depending on a situation, users may choose to use or adapt or not use the stages, phases, tools, techniques in the development project.

Post-methodology Era

In the post methodology era, the focus of the work is on the review and reassessment of the use of ISDM by researchers and practitioners. As a result of the reassessment, developers turned their effort to the following directions: external development, continuing refinement and improvement, ad-hoc development and contingency, agile development and consolidation. External development characterised the use of software packages, outsourcing or offshoring instead of developing in-house applications. When the choice was made to develop applications internally, focus was on perfecting and improving the current methodologies or developing new one. As discussed earlier, new methodologies were typically developed to address limitation of existing methodologies or to accommodate new phenomena such as web-based system. A contingency approach was taken if users need to adapt the methodology according to the particular needs of each circumstance while a more risky and informal approach to ISD is to adopt an ad-hoc development. Agile development offers speed and flexibility as well as strong user and customer involvement support. Avison and Fitzgerald (2006b) argued that the future of the methodology was toward consolidation of methodologies. The study by Hons (2012) provides some evidences of this condition when she found some organisations in South Africa combined agile approach with other system development methodologies to form hybrid methodologies to facilitate the information systems developing process.

In this study, the researcher is interested in the two directions during the post-methodology era as coined by Avison and Fitzgerald (2006b), namely the contingency and continuing refinement and improvement approaches. Following the contingency approach, practitioners often adapt or tailor traditional ISD to match the specific circumstances of their projects (Burns and Deek, 2011). In terms of continuing refinement and improvement approach, the researcher is particularly interested in the development of methodologies to deal with the web-based applications. The following section discusses issues concerning the development of web-based applications.

2.1.2 *Issues in web-based applications development*

Some authors argue that web-based application systems are characterised by an

unprecedented mix of features that makes them radically different from traditional information systems (Myers *et al.*, 1996; O'Reilly, 2005; M. A. Taylor, 2006; French, 2011). Several authors have suggested a number of characteristics of web-based development projects that make them different from their traditional information systems (Howcroft and Carroll, 2000; Baskerville and Pries-Heje, 2001; McDonald and Welland, 2001; Liaw and Huang, 2002; Standing, 2002; Escalona and Koch, 2004; Lang and Fitzgerald, 2006). Among the popular characteristics of web-based applications include rich user experiences, short development cycle, multi-disciplinary teams, imprecise requirement, multi-platform environment, release early and often and parallel development. A lengthy discussion about web 2.0 applications which fall into this web-based application category is provided in Section 2.2.1. Table 2 shows web-based applications' characteristics.

Characteristics		References
Rich user experiences	- Multimedia content including text, image, graphic, sound, voice, animation - Rich, interactive Graphical User Interface style	Liaw and Huang (2002) ; Lang and Fitzgerald (2006); O'Reilly (2005)
Short development life cycle	- Rely on prototyping - Release early and often	Baskerville and Pries-Heje (2001); McDonald and Welland (2001); Howcroft and Carroll (2000).
Multidisciplinary team	- System analysts, customers, users, graphic designers, marketing coordinators, multimedia personnel	Escalona and Koch (2004); Standing (2002); McDonald and Welland (2001); Baskerville and Pries-Heje (2001)
Multi-platform environment	- Web-based systems can be executed independently on various platform	Liaw and Huang (2002); O'Reilly (2005)
Imprecise requirements	- Contain uncertainty and ambiguity	Baskerville and Pries-Heje (2001; 2002)
Parallel development	- Examples include, database development can take place at the same time as the graphical design	Baskerville and Pries-Heje (2001; 2002)

Table 2 – Characteristics of Web-based applications

Some authors argue that because of the differences between web-based applications and traditional information systems, traditional ISDM may not be suitable to be exclusively applied to develop web-based applications (Russo and Graham, 1999; Carstensen and Vogelsang, 2001; Barry and Lang, 2003). Thus, Murugesan et al.(2001, p. 4) express the need "for disciplined approaches and new methods and tools for development …" of web-based applications. Consequently, many new methodologies for web-based system development have been proposed (Isakowitz *et al.*, 1995; Howcroft and Carroll, 2000; Standing, 2002;

Vidgen *et al.*, 2002).

However, there are several researchers who argue that the design of web-based applications does not present any fundamentally new or unique challenges (Lang and Fitzgerald, 2006; Kautz *et al.*, 2007), thus there is no need for new paradigm for ISD or new concepts or theories in Information System (Kautz *et al.*, 2007). For example, in their survey of the use of methods and techniques for hypermedia systems design in practice, Lang and Fitzgerald (2006) found that designers in Ireland used hybrid adaptations of traditional approaches tailored to the specific challenges of hypermedia development projects. The study shows that traditional approaches to system development are still relevant to be applied to web-based application by tailoring it to fit with the specific need of the problem. However, Kautz et al. (2007) caution not to associate observed practice in web-based systems development with good practice.

In order to explain the contradiction discussed above, Baskerville et al. (2007) offer their view on the possible reasons. First, it is a possibility that the phenomena used for comparison by both perspectives may not be the same. Taking their study as the base for comparison, Baskerville et al. (2007, p. 242) argue that the web development which is the focus of Kautz et al. (2007) and the agile development approaches they studied are not equivalent. Furthermore, web projects characteristics may not be the same as agile projects characteristics. Second, contradictory results may be derived from applying different analytical frameworks to the same underlying phenomena. Third, Baskerville et al. (2007, p. 243) believe that "the definitions or the analytical frames applied by the researcher are not the ultimate determinant of whether the problems and practices are the same or different".

2.1.3 *Web-based Information System Development Methodology*

This section discusses four well-known web-based ISDMs namely Relationship Management Methodology (RMM), Internet Commerce Development Methodology (ICDM), Web Information System Development Methodology (WISDM) and Object-oriented Hypertext Design Method (OOHDM). This thesis does not intend to provide a comprehensive discussion of each of the selected methodologies, but instead presents a brief overview of the methodologies for the purpose of introducing them. The discussion of the selected methodologies is structured based on the definition of ISDM given by Huisman and Iivari (2006) provided in section 2.1.1.

Relationship Management Methodology (RMM)

According to Isakowitz et al. (1995) the RMM was introduced to cater for the development of hypermedia applications on the Web. Since its introduction, the RMM has evolved to accommodate the whole process of hypermedia development from requirement to implementation (Isakowitz *et al.*, 1995). The RMM is a **structured** methodology. The design phased is preceded by feasibility studies which cover activities such as the objectives of the hypermedia application being developed, market and user analysis, information sources and permission, distribution channel and cost-benefit analysis. As for the process model, the RMM follows a **linear process**, but some steps are suggested to be done in parallel. There are **seven stages** in the RMM including Entity Relationship design, slice design, navigation design, conversion protocol design, user interface design, run-time behaviour design and construction and testing. **Tools and techniques** available include entity relationship diagram.

Internet Commerce Development Methodology (ICDM)

The ICDM provides a guiding framework for developers to build business-to-consumers applications (Standing, 2002). The author of the ICDM **believes** that the e-business development is part of organisational initiatives. Thus, it is imperative to address not only technical details of design and implementation but also strategic, business, managerial and organisational culture issues. In terms of the **process model**, the ICDM specifies the sequence of stages of the methodology starting with defining e-business strategy and ending with evolutionary phase. The methodology also indicates that there could be some iteration considering the rapid changing nature of the web-based environment. As far as the development **method** is concern, the ICDM has seven stages including e-business strategy with two sub-stages – meta-development and component strategy, logical functional requirement, technical stage consisting of physical architecture and design, Implementation and Evolution. **Tools and techniques** offered include SWOT analysis, business process re-engineering, value chain analysis, and brainstorming.

Web Information System Development Methodology (WISDM)

The WISDM was developed by Vidgen et al. (2002) using the Multiview2 (Avison and Wood-Harper, 1990; Avison *et al.*, 1998) as the guiding framework for developing web-based ISDM. The **underlying philosophy** of WISDM follows that of Multiview which not only consider technological but also organisational and human aspects when developing an

information system. In addition, WISDM can also be considered as following the contingency approach whereby it allows developers to construct particular methodology based on the framework that is suitable to the specific situation (Vidgen *et al.*, 2002). As for **process model**, the WISDM offers development matrix that support phases in the development process such as organisational analysis, information analysis, technical design and work design but the phases can be approach from any aspect. However, in terms of analysis and design phases in the system development life cycle, WISDM supports iterative process. This means that there is no sequence of order in undertaking work within the matrix. In terms of system development **methods**, the WISDM provides a set of methods that developers can choose to fit with their particular needs such as e-business strategy, soft system methodology, Effective Technical and Human Implementation of Computer-based Systems (ETHICS), participative design, structured systems analysis and design, and object-oriented design. Last but not least, the **techniques and tools** provided by WISDM include data flow diagram, entity relationship diagram, use cases and class diagram.

Object-oriented Hypertext Design Method (OOHDM)

In contrast to the structured approach to hypermedia application development offered by RMM, as the name implies, the OOHDM recommends an **object-oriented** approach (Schwabe and Rossi, 1995). The **sequential process** model is proposed as the outcomes of each activity are strongly related to next activity. The OOHDM consists of **five phases** including requirement gathering (Rossi *et al.*, 2001), conceptual, navigational, and abstract interface design and implementation. The **tools and techniques** available are based on Unified Modelling Language (UML) such as use cases and sequence diagrams.

2.1.4 *Comparison of Web-based Information System Development Methodologies*

As discussed in the preceding sections, there are many different web-based ISDMs that have been developed since late 1990's (Lang and Fitzgerald, 2006). It is obvious that no methodology can claim that it can be simply applied to any situation. Thus, it is important to select the most appropriate methodology. In this thesis, the evaluation framework developed by Avison and Fitzgerald (2006a) is adapted to compare four well-known web-based ISDMs discussed in section 2.1.3. The intention is that by comparing different methodologies based on the adapted framework, it could provide some indications in choosing the best methodology for this study. For the purpose of this thesis, only some elements of Avison and Fitzgerald (2006a)'s framework are considered.

Philosophy

A philosophy is viewed as a set of assumptions and theories underlying the methodology. The philosophy of a methodology is shaped by four factors:

- Paradigm – it is "the most fundamental set of assumptions adopted by professional community that allows its members to share similar perception and engage in commonly shared practices" (Hirschheim and Klein, 1989, p. 1201). Two relevant paradigms are distinguished: science and system. A science paradigm emphasis on "… reductionism, repeatability and refutation" while a system paradigm focus on understanding "… the whole picture, the emergence properties, and the interrelationships between parts of the whole" (Checkland, 1976, p. 128). Based on this classification, WISDM and ICDM fall into a system paradigm whereas RMM and OOHDM fall into the science paradigm.
- Objective – The objective of a methodology might be to develop an information system or to analyse and change other elements in the organization. All web-based methodologies being considered in the comparison belong to the 'develop' information system category of methodology objective.
- Domain – this refers to the situations that the methodology addresses. For example, a methodology may focus on solving a specific problem or seeking to address a broader view such as organisational needs of information system and its general planning, organisation and strategy. The RMM and OOHDM mainly focus on solving specific problem. Since WISDM and ICDM provide a planning procedure from technical and organisational perspectives, these methodologies can be said to addresses a wider view of the organisation.
- Target – reflects the applicability of the methodology. The target of a methodology can be classified as either for a general purpose or particular types of problems. The size of an organisation that a methodology addresses could also be used as a basis for methodologies' comparison (Avison and Fitzgerald, 2006a). In the case of RMM and OOHDM methodologies, formerly they were only suitable for developing small to medium-sized web-based projects. However, with the enhancement made on the methodologies, their authors claim that they are recently able to handle complex projects. As for WISDM and ICDM methodologies, it was argued that they could be adopted to develop a medium to large-sized web-based applications.

Scope

The scope of a methodology refers to the stages of information systems development life cycle that a methodology covers. Some methodologies do not follow a systems development life cycle; hence it can be quite problematic to use this dimension in the comparison. There are nine stages in the development life cycle namely:

- Strategy – covers information system planning, strategy
- Feasibility – concerns with the evaluation of economic, technical and social aspects of the system.
- Analysis – involves user requirement analysis
- Logical design – describes the processes and functions of the system
- Physical design – concern with physical design including system's internal and external entities.
- Programming – connotes physical development of a system
- Testing – test a system, program and procedure
- Implementation – planning and implementation of technical, social and organisational aspects
- Evaluation – evaluate the implemented system
- Maintenance – improvement of the methodology

Table 3 shows the stages of the life cycle that are covered by RMM, OOHDM, WISDM and ICDM. The dark grey area indicates the stages that a methodology put an emphasis on while the light blue area represents the stages that a methodology is trying to cover but it may not be fully explained.

	Strategy	Feasibility	Analysis	Logical design	Physical design	Programming	Testing	Implementation	Evaluation	Maintenance
RMM										
OOHDM										
WISDM										
ICDM										

Table 3 – The stages of the system development life cycle that are covered by web-based methodologies (adopted from Fuangvut (2005))

Outputs

This component is concerned with the output that a methodology produces at each stage of the development process. Table 4 shows the comparison of the web-based methodologies based on the output that each produces.

	Deliverables	Final output
RMM	ER diagram, ER+ diagram, RM diagram used in the design and construction	A basis for the development process
OOHDM	User interaction diagram, conceptual design, navigation design, interface design	A complete web-based system
WISDM	Work design, technical design	A complete web-based system
ICDM	Strategies for business	A complete web-based system

Table 4 – Comparison of deliverables and final output of RMM, OOHDM, WISDM and ICDM

Based on the evaluation above, it shows that there are several similarities and differences between the methodologies. In terms of the similarities, all methodologies aim to deliver a complete web-based system with the exception of the RMM, which focuses on providing a basis for the development process. The methodologies seem to be different in terms of their underlying philosophy. Both WISDM and ICDM focus on a broader organisation view that take both technical and organisation aspects, whereas RMM and OOHDM follow data driven approach that focus more on specific problems.

2.1.5 *Understanding WISDM*

Continuing the discussion provided in section 2.1.3, this section delineates the details of WISDM. The WISDM was developed through several cycles of action research based on the Multiview framework. Therefore, it is appropriate to start the discussion by introducing the Multiview framework.

Multiview was developed as a response to the criticisms of traditional ISDMs that had strong roots in engineering discipline and technical rationality (Vidgen *et al.*, 2002). Multiview is based on three tiers: a) general framework; b) local, emergent methodology; and c) methods/techniques. Known as a framework of ideas, Multiview provides a basis for constructing a situation-specific methodology. This emergent methodology is constructed based on the interaction of IS developers with the problem situation. The interaction which is historically contingent and locally situated provides guidance in selecting appropriate methods and techniques to improve the problem situation. Similarly, the methods used could

influence the way situation is perceived and the type of intervention. Figure 5 shows the Multiview framework.

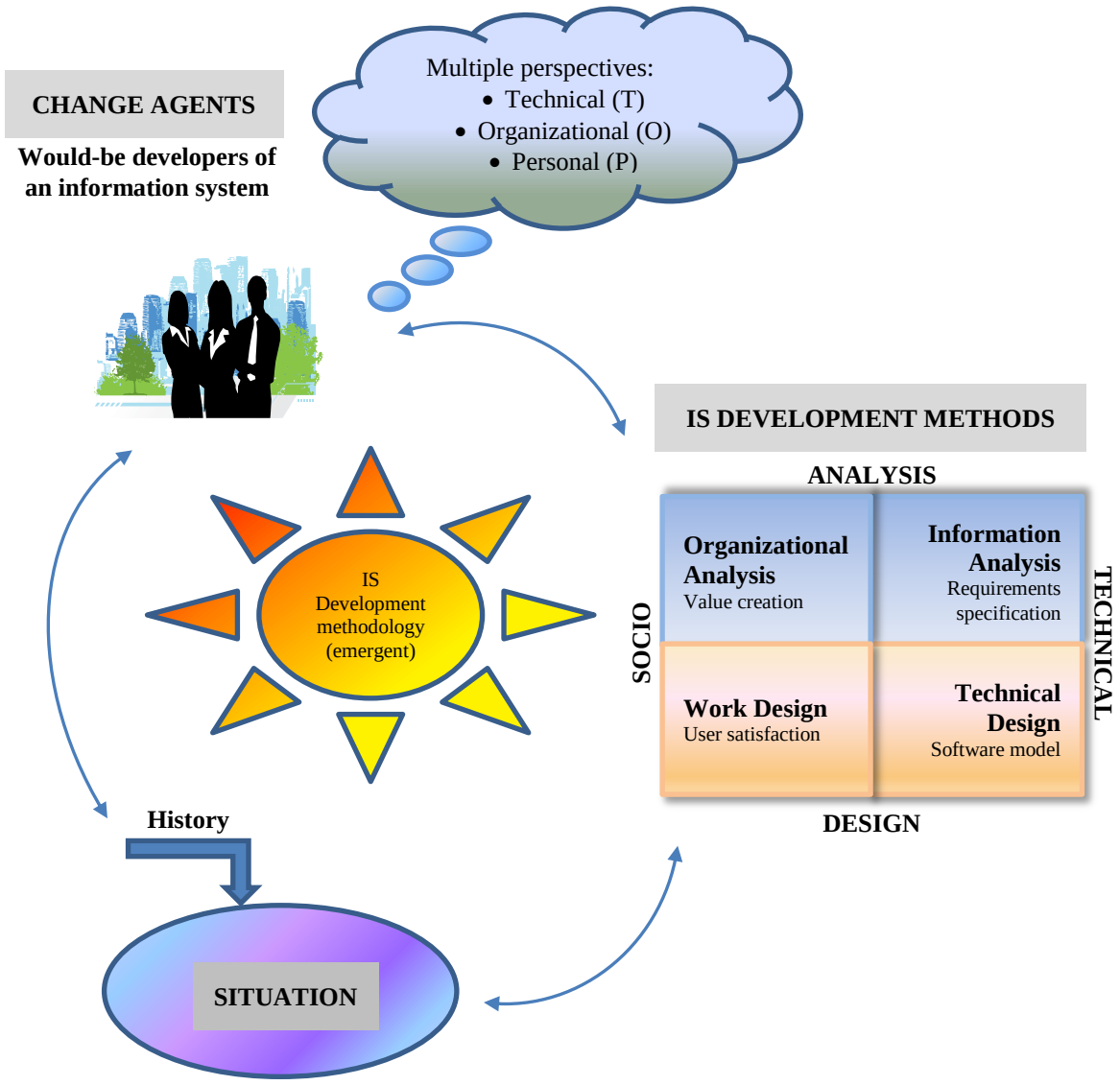


Figure 5 – Multiview Framework (Vidgen *et al.*, 2002)

The IS development methods within the Multiview framework can be exploited by developers to understand and interact with the problem situation. Furthermore, the IS methods is considered as a general tools in which specific people can draw upon in specific circumstances to create a local methodology in practice. One such methodology is the WISDM.

The WISDM matrix

The WISDM development methods matrix (see Figure 6) consists of five components. These

components are arranged in five specific quadrants within two dimensions. Horizontally, the components fall either on the analysis (top) or design (bottom) dimension. Vertically, the components are either considered as socio (left) or technical (right). The WISDM takes into consideration both the technical and socio approaches to system development. The right hand side of the matrix is dedicated to technical, engineering based approaches in which user requirement analysis and software model are conducted and generated respectively. The left hand side of the matrix focuses on more social and organisational issues such as conducting value creation and user satisfaction analysis. Now let's look at each quadrant more closely.

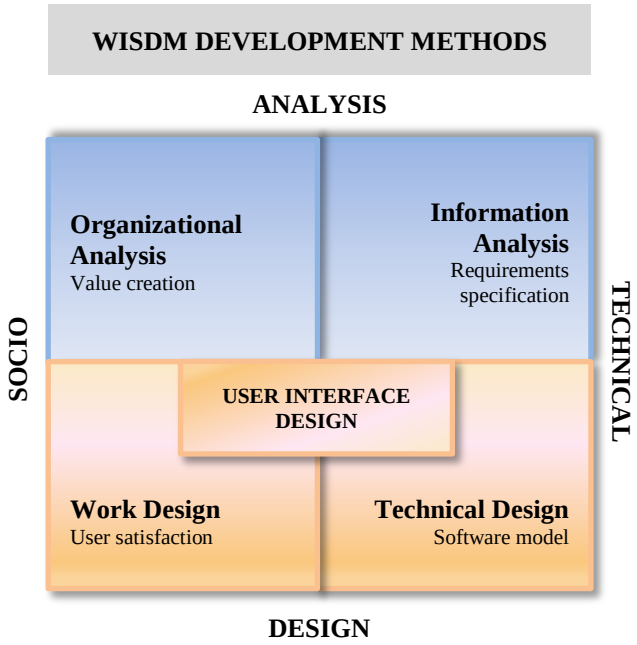


Figure 6 – WISDM matrix (adapted from Vidgen et al. (2002))

Organisational Analysis

The main focus of the analysis in this quadrant is related to the creation of value. Any web-based information systems development need to consider whether the project fit within the organisation's goal or strategy. Therefore, in order to ensure that the development project align with the organisation strategy, developers need to perform problem situation analysis by using any methods provided by the framework such the system's thinking and soft system methodology.

Work Design

The work design places emphasis on the sociotechnical approaches to system analysis and design of web-based information system. The sociotechnical approaches aim to include users

in the design process in an anticipation to establish satisfactory fit between people and technology. In the web-based environment, users of the web-based system not only cover users within the organisation such as employees but also cover users external to the organisation such as customers, suppliers, partners, collaborators and investors.

Within the WISDM framework there are two socio-technical approaches to information systems design namely ETHICS and participative design. Effective technical and Human Implementation of Computer-based Systems (ETHICS) was developed by Enid Mumford (1995). ETHICS encourage user participation not only in identifying user requirement but also in the evaluation of "after-the-event prototype" (Vidgen *et al.*, 2002, p. 303). Furthermore, users together with technical designers engage in collaborative work to identify problem situation, to set objectives and to redesign work practices and organisational structure. The aim of users' participation in these activities is to ensure that the socio-technical system works efficiently and effectively. Beside participation, ETHICS also concerns with user satisfaction. Mumford (1995, p. 311) defines job satisfaction as "the goodness of fit between what employees expect and need from work and what they are required to do by the organisation".

Originating from the work of Scandinavian software development traditions, participative design focuses on democracy in the workplace (Foth and Axup, 2006). Participative design supports collaborative work of users, developers, workers and management with different areas of expertise in various activities the design process such as identifying technologies and work practices and prototyping of idea. The aim of participative design is to produce workable designs in a humanistic fashion by involving all stakeholders in the design process (Foth and Axup, 2006).

Information Analysis

Information analysis involves works in producing a formalised specification of the organisation's information and process requirements. The specification can be in the form of graphical notation or/and a software prototype. Two traditional system analysis and design method can be used to analyse system requirements namely structured systems analysis and design and object-oriented analysis and design. As for modelling requirements, WISDM favours Unified Modelling Language (UML).

Technical Design

Analysis is concern with 'what' the application will do, whereas design focuses on how the ends will be achieved in software terms. Specifically, technical design involves constructing a software model which includes data structures and program design.

Human Computer Interaction (HCI)

The HCI component overlaps work design and technical design quadrants. The aim of HCI is to design the user interface of a web-based application by drawing upon the web site design principles. The design of user interface is one of the important activities in the system development of the Internet era. This is due to the fact that in certain organisation (for example the dot-com companies), the user interface act as a window to their businesses. Thus, in order to design appealing and usable user interface, a skilled graphic designer is needed. Consequently, developers may consider including an experienced graphic designer as part of the development team or to train existing team in web graphic design or buy a proprietary web site template.

2.1.6 *Information Systems Prototyping (ISP)*

Information Systems prototyping is a relevant approach for system analysis and design. Despite an absence of action research theory in its development, it appears to fall within the boundaries of action research (Baskerville and Wood-Harper, 1998). It is categorised as an iterative process, with a rigorous and collaborative or facilitative features since it promotes iterative cycles and collaboration between the researcher and participants in developing an effective information system. Doke and Swanson (1995, p. 173) define prototyping as "a process that produces a model of a system or part of a system and requires user involvement. The prototyping process quickly creates a working model for user interaction and evaluation."

Previous research on e-learning (Holsapple and Lee-Post, 2006), system development (Janson and Smith, 1985) and web site design (Kinzie *et al.*, 2002) have successfully utilised the prototyping method in their development of a system. Alavi (1984) argued that the use of a prototype is highly recommended in situation where there is a need for experimentation and learning before commitment of resources to development of a full scale system. As the situation of this research is similar to the condition described by Alavi (1984), the prototyping method was chosen to design and develop the postgraduate research portal. Furthermore,

Zhang et al. (2005) claimed that a functional prototype can stimulate users to offer in-depth and valuable feedback on features and interface design.

2.2 Overview of Web-Based Technologies

In section 1.6, e-learning was defined as the use of web-based technologies to support learning. Considering that the design of a web-based application – in this case a postgraduate portal - lies at the core of this thesis, it is appropriate to delineate the tools and technologies that could provide facilities to support research programmes. This section discusses those web-based technologies which have some distinct impact on blended learning in higher education institutions. Since the focus of this study relates to research programmes, the review also examines web-based applications that have been developed to facilitate the research process within and across institutions.

2.2.1 *Web 2.0*

The term Web 2.0 was first coined by Dale Dougherty, a Vice President of O'Reilly during a brainstorming session between O'Reilly and MediaLive International (O'Reilly, 2005). In a shorter version of the Web 2.0 concept, Anderson (2007, p. 5) presented the following definition:

> "Web 2.0 refers to a group of technologies which have become deeply associated with the term: blogs, wikis, podcast, and RSS feeds, which facilitate a more socially connected Web where everyone is able to add to and edit the information space".

For the purposes of this thesis, the definition of Web 2.0 given by Anderson (2007) is sufficient. O'Reilly (2005) discussed in detail the seven principles that govern Web 2.0 which include:

- The Web as platform;
- Harnessing collective intelligence;
- Data is the next 'Intel inside';
- End of the software release cycle;
- Lightweight programming models;
- Software above the level of single device; and
- Rich user experiences.

The principle of the Web as platform is the idea of developing an application that provides services. In this view, it suggests the web browser to replace the functions of a desktop operating system. Traditionally, people develop software that runs on specific platform such as Windows or Linux. However, by the notion of the Web as platform, developers build web-based applications that run on the Web.

The principle of harnessing collective intelligence which is directly relevant to this thesis is concern with the value created by collective contributions of participating users. Examples are when users add or edit articles in Wikipedia, share tagged photos on Flickr, share bookmarks on Del.icio.us or stream their personal blogs into the open blogosphere world (Gruber, 2008).

In the internet era, people generate and use a great amount of data. In Web 2.0, this data is profoundly important as O'Reilly (2005, p. 3) stated in his paper "the value of the software is proportional to the scale and dynamism of the data it helps to manage". This data can be collected indirectly from users when they use internet services and applications such as Google, Amazon and Ebay. For example, when a user buys a book from Amazon, his buying choices will be collected. Amazon then uses this data together with other collected information to recommend a book to a user. Besides Amazon, Google is another company that has developed the ability to collect and manage this data on an epic scale.

In web 2.0 environment, applications are no longer released in version-based software packages, instead are constantly refined and improved. One reason as O'Reilly (2005) argues is that "the software will cease to perform unless it is maintained on a daily basis". This fact leads to a number of fundamental changes in the practices of software development. First, users must be treated as co-developers. One successful approach to encourage mass participation is to provide an architecture that is easy to use, thus lowering the barriers to participation. Second, to design a system that will take the user interactions and utilise them to improve itself. One example of such system is the Google search.

Another principle is the lightweight programming models that allow for loosely coupled systems. In Web 2.0, we are able to incorporate tools or services that reside anywhere in the world into our own application to make it more powerful. This approach is also known as 'innovation in assembly' where we can create value simply by assembling available tools and services in effective ways.

O'Reilly (2005) argues that the principle of software above the level of a single device would be one area that will have some great changes. The idea behind this principle is that web applications should be designed so that they display appropriately on all devices. This is because not only PC-based browser allows users to view web pages but an increasing number of hand-held devices support browsing the web.

Last but not least is the principle of rich user experiences. This principles not only concern with the capability of delivering multimedia content and GUI-style (Graphical User Interface) application experiences but also PC-equivalent interactivity. One example is the Gmail application provided by Google. Gmail offers not only a rich user experience similar to that of a desk mail program but also can be accessed from anywhere and has a strong database search capability.

He also presented a meme map of Web 2.0, as illustrated in figure 7.

Figure 7 – Meme map of Web 2.0 adopted after O'Reilly (2005)

The following paragraphs provide a brief introduction to the Web 2.0 tools.

Blogs

The term 'weblog' was first introduced in 1997 by Jorn Barger (Blood, 2002) and shortly afterward it was abbreviated to 'blog' by Peter Merholz in 1999 (Loving *et al.*, 2007). Blogs are simple web pages consisting of a list of dated entries called posts that are typically arranged in reverse chronological order (Williams, 2008). According to Herring et al. (2004), blogs may be classified into several genres. Firstly, blogs can be of type filters in which the blogger includes link to- and comments on the contents of other web pages. Secondly, blogs can fall into personal journal's type in which the blogger report on their personal lives and inner thoughts and feelings. Thirdly, blogs can be classified as knowledge blogs or k-logs, in which the content of the blog includes observations and several references about a particular knowledge domain. Lastly, blogs can be categorised as being mixed purpose, in which authors combine the functions of two or more of the first three genres. In addition to reverse chronological order, other typical features of blogs include an individual ownership, a hyperlinked post structure and an archive of postings (Jeffrey Wee Sing Sim and Hew, 2010).

Wikis

The word wiki is derived from the Hawaiian term, 'wiki wiki', which means quick (Leung and Chu, 2009; Majhi and Maharana, 2010). Wikis are websites that allow anybody to build up a corpus of knowledge by adding, removing or editing and changing available content through their easy to use and flexible functionalities (Majhi and Maharana, 2010). Similar to weblog, wikis have been claimed to support communication between student-instructor and student-student interaction (Ellis and Cohen, 2009). While the content of a blog is displayed in reverse chronological order, wiki pages have no inherent structure (Duffy and Bruns, 2006). Therefore, wiki pages can be interconnected and organised as required. Research studies reveal that wikis can be an effective tool for communication (Sauer *et al.*, 2005), collaborative learning and writing (Bold, 2006; Leung and Chu, 2009) and knowledge creation and management (Lund, 2008).

Really Simple Syndication (RSS)

RSS stands for Really Simple Syndication, is a standardised format used to publish syndicated content (Hammersley, 2003; Wittenbrink, 2005). The syndicated content or feed is website content that is generated for use by other services (Hammersley, 2003; Miller, 2003). It can

contain both the website's full or summarised text and metadata - information about the content (Hammersley, 2003). The users of the RSS feeds will be notified of the syndicated content's updates automatically. One of the benefits of the RSS feeds is it allows users to quickly scan headlines or read article of interests (Housley, 2004).

Podcasts

A podcast is essentially a digital audio recording that can be manually downloaded or automatically downloaded via RSS technology onto a personal computer or any portable device (M.J.W. Lee and Chan, 2007; Walls *et al.*, 2010). Some podcasts consist of audio files enhanced with graphics and some consist of full video recording called Vodcasts or videocasts (Absher *et al.*, 2007). Podcasts have been used to enhance the study environment in two forms: repetitive and supplementary (Walls *et al.*, 2010). In their repetitive form, podcasts have been used to store lecture recordings where students were able to download and listen to them anytime, anywhere (van Zanten, 2008) while in their supplementary form, podcasts have been used mainly to complement and augment the lecture material (Edirisinga *et al.*, 2007; M.J.W. Lee and Chan, 2007; Hartfield, 2011).

Social Networking Applications

Social networking applications, otherwise known as social networking sites (SNSs) are "member-based Internet communities that allow users to post profile information, such as username and photograph and to communicate with others in innovative ways such as sending public or private online messages or sharing photos online" (Pempek *et al.*, 2009, p. 227). Examples of SNSs include but are not limited to MySpace, Facebook, Cyworld and Bebo. Facebook has become the most popular SNSs for college students (Roblyer *et al.*, 2010). It was reported that SNSs have been used to improve communication and to establish a sense of community amongst students and instructors in higher education institutions. For example, Pempek et al. (2009) in their study on how college students socially interact on Facebook found that most respondents (85%) reported that they used Facebook to communicate with friends, especially to those who are not on campus. Furthermore, Mazman and Usluel's (2010) research on the educational usage of Facebook supported Ajjan and Hartshorne (2008) and Lockyer and Patterson (2008) findings that SNSs support communication, collaboration and material and resource sharing. However, Lockyer and Patterson (2008) caution instructors planning to use SNSs in their teaching and learning to take into consideration students' technical skills with SNSs technologies and the professional and personal issues that may

come with open SNSs.

2.2.2 *Virtual Learning Environment (VLE)*

Virtual Learning Environments (VLEs) are a widely used platform for e-learning. The Joint Information System Committee (JISC) defined VLE as "the components in which learners and tutors participate in 'online' interactions of various kinds, including online learning" (2000, p. 3). Britain and Liber (1999), in their evaluation of VLE in the HE sectors, proposed a set of functionalities for a prototypical VLE system, as shown in figure 8.

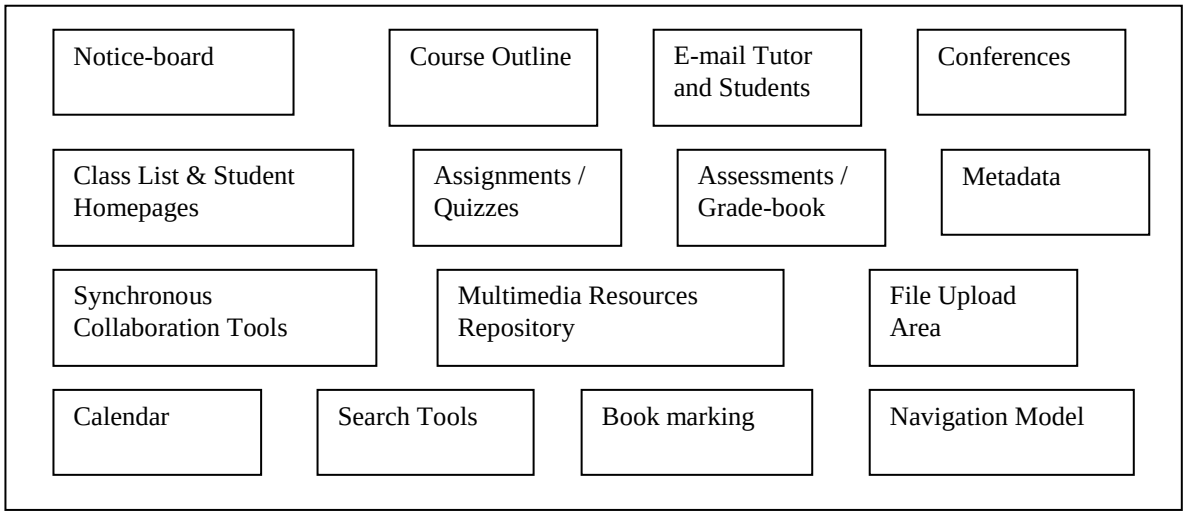


Figure 8 - A schematic of a prototypical VLE (Britain and Liber, 1999)

The VLE functionalities shown in figure 8 may be grouped into four categories: communication, storage management, assessment and support facilities (Bostock, 2000). Communication tools include notice boards, e-mail, conferences, calendar and synchronous collaboration tools. A notice-board is a feature that appears each time users log into the system. Normally, students will find useful information about their courses here. Typically, most VLEs provide e-mail facilities that can be used by instructors and students on a course. Conferences refer to asynchronous discussion tools such as threaded forums that enable students to engage in collaborative exchanges about topics on a course. Most VLE systems support an online chat feature. However, other synchronous collaboration tools such as whiteboards, group browsing and video conferencing are features provided by only a few VLE systems (Dammann *et al.*, 2005).

Storage management facilities allow instructors to manage learning resources within a VLE. Multimedia resources and file upload areas are examples of these facilities (O'Leary, 2002). Multimedia resources are educational materials such as interactive simulations, which form

part of course packages. Typically, VLE systems allow these resources to be easily stored and accessed. A file upload area is a feature that allows learners to upload files from their local computers and to share these files with instructors, or with other students in an online course.

Assessment facilities in a VLE provide instructors with the tools to create, store, administer and grade online assessments (Tsinakos, 2004). Alternatively, students are allowed to submit their assignments electronically to the instructors for evaluation. Many systems provide some form of formative and summative assessment. Most typical systems allow a wide range of question types such as true/false, multiple choice, fill-in the blanks, ordering, matching and essays.

Besides communication, storage management and assessment facilities, some VLEs provide support tools such as search tools, book marking and navigation structures (O'Leary, 2002). The volume of educational materials can become very large when a course is developed. Thus, search tools become important to locate specific materials quickly and easily. Most systems allow students to search course materials using the title, the name of a file or the writer of materials (Tsinakos, 2004). In addition to search tools, some systems also provide book marking facilities. A bookmark allows learners to return easily to important pages within their courses. Some students will work by using hyperlinks or linear sequences of instructional materials. However, some VLEs provide a navigation structure that is more flexible, and will accommodate alternative information structures such as a hierarchical tree structure. In general, a hierarchical tree structure provides a course outliner with links to the course content packed into the branches of the tree (Cheng and Yen, 1998).

Other functions include course outlines, class lists and metadata. Course outlines provide an overview of a course structure that may specify dates for assignments, assessments, lectures, and video conferences. Class lists are a register of students enrolled in a course. In addition to names, a list may also include students' e-mail addresses. The list is incorporated into the system to introduce students to their peers. Besides class lists, some systems allow students' homepages to be uploaded to the system. Metadata is structured data that describes the characteristics of an object or resource. For example, metadata describing an e-book within a learning environment may contain author, title and publisher elements. Most current VLE systems provide some sort of metadata schemes to describe learning resources, course units and people (Tsinakos, 2004).

Despite the many features and functions offered by most VLEs, the researcher believes that they are more suitable to be employed to support students on taught programmes rather than research students. This belief is based on several limitations of VLE software in terms of supporting an open learning research study. First, it was argued that the VLE approach replicates the 'closed classroom' teaching and learning model (Chatti *et al.*, 2007; McLoughlin and Lee, 2008). This conforms to a 'student-as-information consumer' model and reinforces instructor- and curriculum-centred approaches to teaching and learning. Therefore, in this instance, the VLE places a strong emphasis on the delivery of information by an instructor, rather than fostering learner-centred learning which is particularly important for research students. Second, VLEs are considered as course-centric rather than community-centric (Ellaway, 2005; Cinque and Martini, 2010). In the context of academic research, forming and engaging in networking activities such as peer review processes is an important activity particularly for doctoral research students. Therefore, a web-based application that provides a community building function is more desirable. Finally, the primary focus of VLEs is generally on teaching and administrative efficiency rather than on learning (Ellaway, 2005; Mott, 2010). Although functions such as course registration, scheduling, notification and tracking of learning events are often the defining parameters of a specific learning environment, they are not directly educationally oriented. According to Ellaway (2005), when a system becomes the primary medium for learning, such learners are expected to use the system for problem solving or establishing networks; thus it can be more reasonably considered as a learning environment.

The shortcomings of VLE described above and the opportunities offered by current technological innovations such as Web 2.0 have caused a great research interest in the learning community resulting in many works proposing approaches that address these issues. One such work is the introduction of Personal Learning Environments (PLE) concept (Archee, 2012; Brown, 2010, Severance et al., 2008). Basically PLE is "a digital space in which the user has the ability to access, aggregate, create, store and share learning materials" (Archee, 2012, p. 419). Since its introduction in the 2004 Joint Information Systems Committee/Centre for Educational Technology and Interoperability Standards conference in the UK (Archee, 2012), various authors have offered their own definitions of a PLE. However, some authors stress on the importance of the technological concept while others stress on its pedagogical benefits when defining PLE. From a technological point of view, Wilson (2008) argues that "a PLE is not a piece of software. It's an environment where

people and tools and communities and resources interact in a very loose kind of way". They conceptualise PLE as an open learning environment where services and resources are from multiple contexts, open and bidirectional (users are allowed not only to consume the resources but also to produce them), customised to the users and that uses lightweight standards and interfaces. PLE also promotes collaborative and open content-oriented and can be seen from both individual and global perspectives (Wilson et al., 2007).

From a pedagogical point of view, Attwell (2007, p. 7) believes that PLEs should not be seen as a software application rather, it is

> a new approach to the use of new technologies for learning. There remain many issues to be resolved. But, at the end of the day, the argument for the use of Personal Learning Environments is not technical but rather is philosophical, ethical and pedagogic. PLEs provide learners with their own spaces under their own control to develop and share their ideas.

Besides PLEs, other initiatives to improve the traditional VLE are by leveraging innovations in web technologies such as the Web 2.0 to introduce the concept of VLE 2.0 (Weller, 2007). According to Weller (2007), based on the Web 2.0 principles, a VLE 2.0 concept could be envisaged. Figure 9 shows a diagrammatical concept of VLE 2.0 as proposed by Weller (2007).

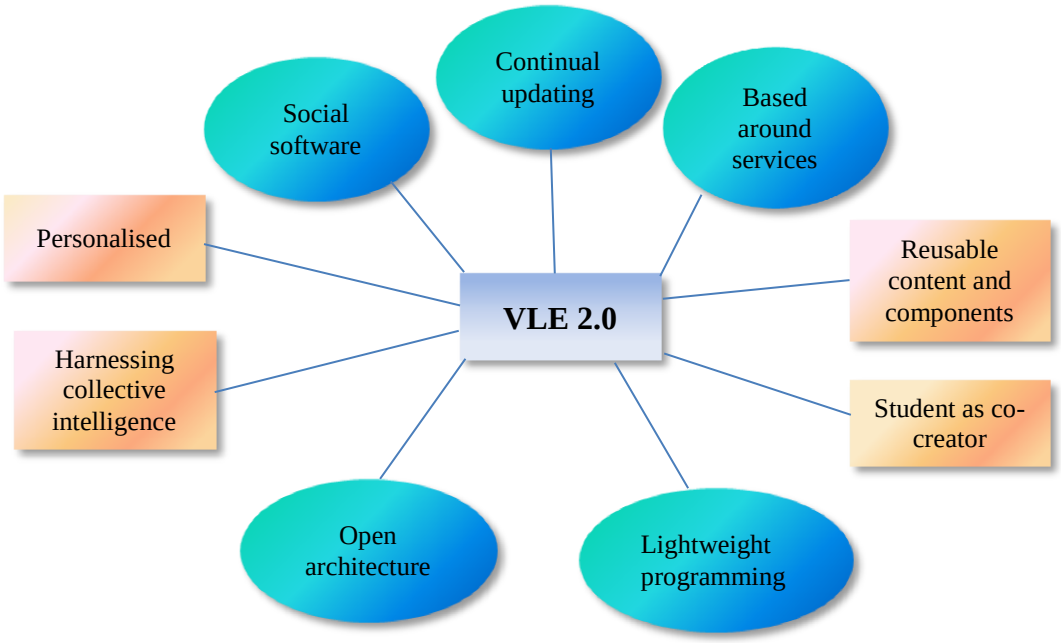


Figure 9 – The VLE 2.0 concept

Wellar (2007) argues that a VLE 2.0 can be developed based around a *service oriented architecture*. The emphasis in this approach is that a tool should be developed in a way that it can be reused in different context and assembled in different ways. VLE 2.0 concept is concern with adopting a *lightweight programming model* in developing VLE 2.0. This model suggests that a new tool can be integrated with VLE, but it should be released first to some specific students. Once the tool is accepted and used by these students, it can be made available to all students and instructors.

VLE 2.0 is also recommended to be based around open architecture and standards where easy coupling and decoupling of tools can be achieved. In addition, Weller (2007) envisions that VLE 2.0 concepts rely on a range of tools and services that can be configured differently for different users thus achieving personalisation. These tools and services might come from various providers ranging from commercial products, open source and in-house solutions. In addition, it is also possible for services from outside of education sector such as Google or Flickr to be integrated into VLE 2.0 (Weller, 2007).

The other concept of VLE 2.0 is the idea of students as co-creators of content. VLE 2.0 with the affordance of a Wiki, allows students to add or edit course content. The content will be updated and evolved as each cohort modifies it thus allowing collective intelligence. The other concept of VLE 2.0 is the reusability. In this context, it is not only about the reusing of the components and tools in VLE but also the learning content. It is expected that once the reuse of tools becomes common, the same will apply to content.

2.2.3 *Virtual Research Environment (VRE)*

Even though VREs have not been directly developed to support teaching and learning, they provide relevant web-based capabilities that are related to research education. The term VRE is widely used in the UK to refer to:

> "the tools and technologies needed by researchers to do their research, interact with other researchers (who may come from different disciplines, institutions or even countries) and to make use of resources and technical infrastructures available both locally and nationally" (The Joint Information Systems Committee, 2010).

The components of a VRE may include new, as well as distributed and heterogeneous existing systems such as Shibboleth access management and VLEs (Fraser, 2005). In

addition, the context in which those tools and technologies are used should also be incorporated within VREs. The emphasis of a VRE is on the development of a framework and standard rather than developing a complete VRE applications (Fraser, 2005).

In the UK, VRE programmes were funded by the Joint Information Systems Committee (JISC). The programme which was started in 2004 has since completed three phases in which each phase consisted of 15, 4 and 10 projects respectively. Table 5 shows the list of projects under each phase.

Phase	Research Programme	Project Name
I	Biology	IBVRE: A VRE to Support the Integrative Biology Research Consortium
	Humanities	BVREH: Building a Virtual Research Environment for the Humanities
	Generic	ELVI: Evaluation of a large-scale VRE Implementation
	Generic	EVIE: Embedding a VRE in an Institutional Environment
	Orthopaedic surgeons	CORE: Collaborative Orthopaedic Research Environment
	Grid computing, Social science	GROWL: VRE Programming Toolkit and Application
	Engineering	ISME: Integration & Steering of Multi-Site Experiments to Assemble Engineering Body Scans
	Support meeting process	MEMETIC: Meeting Memory Technology Informing Collaboration
	Generic	IUGO: Conference Information Integration
	Humanities and arts	CSAGE: Collaborative Stereoscopic Access Grid Environment
	Archaeology	Silchester Roman Town: A Virtual Research Environment for Archaeology
	Political discourse	Virtual Research Environment for the History of Political Discourse 1500-1800
	Generic	Implementing the Kepler Workflow Interface into the Cheshire Digital Library
	Generic	eReSS: e-Research Tools and Resources Interoperability project
	Education	Sakai VRE for Educational Research
	Generic	Sakai VRE Portal Demonstrator
II	Generic	CREW: Collaborative Research Events on the Web
	Generic	myExperiment
	Humanities	Study of Documents and Manuscripts
	Archaeology	Virtual Environments for Research in Archaeology
III	Generic	BRAIN: Building research and innovation networks
	Cancer	Cancer Imaging VRE
	Business	CRIB: Collaborative research in business
	behavioural scientists	IBBRE, Internet Based Behavioural Research Environment
	Generic	Institutional scholarly comms with integrated publication sharing
	Generic	LinkSphere
	Generic	ONE VRE
	Humanities	TEXTvre
	Generic	ViCo-VRE, Video Conversion on PAG
	Clinical researcher	VRIC: Virtual research integration collaboration (VRIC)

Table 5 - The JISC Virtual Research Environment projects

Based on table 5, it is clear that the focus of VRE was to provide a set of tools in discipline specific areas such as orthopaedics, education, arts and humanities; encouraging the development of collaborative tools; and evaluating and improving current VRE projects.

Furthermore, the target users and collaborative partners of the JISC VRE projects were not doctoral researchers. The developed VREs were built to support specific research problems (such as the ISME project) undertaken by experienced academics or scholars. Hence, developed VREs were less suitable to support research students. Considering that research students may come from diverse backgrounds and may be fresh from undergraduate study, their research experience may greatly differ from that of experienced students or scholars. Therefore, in order for VREs to better serve research students, they need to be developed on the basis of the needs and requirements of research students.

2.2.4 *Portals*

Since the proliferation of e-learning, a wide range of new products has been developed and many new companies have entered the learning technology market. New categories of product continue to emerge, some providing new capabilities and others combining existing functionalities into new product configurations. It may be a challenge to determine how these systems relate to each other and how they fit into a complete e-learning environment. The emergence of e-learning does not mean that existing software applications are obsolete. Systems such as Student Records, Timetabling, Finance, and Library Management provide critical components of e-learning environments. The challenge is to integrate these systems effectively with e-learning application services. One such initiative is to adopt a portal technology. In the UK, universities such as Hull, Nottingham, Bristol and De Montford have adopted a portal technology to incorporate their e-learning systems (Kraan, 2002). In this thesis, a portal is conceptualised as a generic infrastructure which integrate a wide range of applications such as VLE, blogs, RSS and social networking applications that will provide ecology for learning to take place.

A portal is "a possibly personalised, common point of access where searching can be carried out across one or more than one resource, and the amalgamated results viewed. Information may also be presented via other means, for example alerting services and conference listings or links to e-prints and learning materials" (The Joint Information Systems Committee, 2006). The advantage of a portal as compared to web sites is its ability to provide only the information and tools that each user needs.

Connolly (2000, p. 39) defined a portal as "a gateway to the (w)eb that allows the plethora of information available on internet and intranet (w)eb sites to be organized and customized

through a single entry point". In addition to personalised information, users may configure a portal to display the information or features they wish to see. The features available to any one individual may be different, depending on their role and personal interest within an organization. This is the definition of a portal that this thesis adheres to.

In this research, a prototype postgraduate portal was developed to support research students throughout their research life cycle. In the following sections, the thesis provides discussions of the evolution of portals and the applications of portals in HE institutions. Next, it discusses the types of available portals, with the intention of positioning the postgraduate portal developed within the broad classifications of portal and lastly the important features of portals.

The evolution of portals

The evolution of portals can be traced back to the first personalised Internet portal called My Yahoo™ (White, 1999), which was introduced in 1998. It was developed initially as a search engine to help consumers to quickly find information that matched their needs on the Internet (Ward and Gardner, 2001). The concept of the corporate or enterprise portal (Dias, 2001) originally derived from the Internet portal that emerged. Eckerson (1999b) identified four generations of corporate portals, as shown in table 6. According to table 6, the development in the first generation portal places emphasis on building the content of the portal. A more user-centric viewpoint was adopted by the second generation, which allowed users to customise their preferred content. In the third generation, interactive features that included collaborative functions were a major focus of development. Finally, all web-based applications were completely integrated into a portal system in the fourth generation.

Eckerson (1999b) argued that the evolution of the corporate portal followed evolutionary stages similar to those experienced by Internet portals, although this happened in a shorter time. For example, the Internet portal took several years to move from one generation to the next, but corporate portals evolved from first to third generation products within only 12 months (Wayne W. Eckerson, 1999b).

Generation	Category	Corporate Portals
First	Referential	Search engine, with a hierarchical catalogue of web content. Each catalogue entry contains a description of the content object and a link to it.
Second	Personalised	Through usernames and passwords, users create a personalised view of portal contents, known as "MyPage". The view shows only the categories and applications of interest to the users. The portal is able to notify users when new content is added to categories that they had previously selected. In addition, users could publish documents to the repository and let others view.
Third	Interactive	The portal embedded applications that increased personal and workgroup productivity such as e-mail, calendars, workflow, project management, etc. This generation provided the collaborative character as well as multiple types of interactive services to corporate portals.
Fourth	Specialised	Portals based on roles for managing specific corporate functions such as sales, finances and human resources. This generations integrated corporate applications with the portal, permitting users to read, write and update corporate data.

Table 6 – Generations of corporate portals (adapted from Eckerson (1999b)

To date, a standardised definition of the term 'enterprise portal' has remained elusive in the academic and industrial literature. One of the reasons for this is the rivalry amongst commercial vendors. In trying to persuade user communities, vendors tend to offer their own definition of corporate portals. For example, if one vendor gets its definition accepted, it gets to suggest that a competing vendor's solution is not really a corporate portal (Firestone, 1999) because it is lacking in certain features. Consequently, terms such as 'business portal', 'knowledge portal', 'corporate portal', 'information portal', 'enterprise portal' and 'enterprise information portal (EIP)' have been used interchangeably (Dias, 2001). The term, Enterprise Information Portal was first defined by Shilakes and Tylman (1998, p. 2) as:

> "Applications that enable companies to unlock internally and externally stored information, and provide users a single gateway to personalised information needed to make informed business decision".

Since then, the development of EIP has evolved not only to enable intra-organisational collaboration, but also inter-organisational collaboration. Another definition offered by Daniel and Ward (2006, p. 116) noted both collaborations. They define enterprise portals as:

> "Secure web locations, that can be personalised, that allow staff and business (partners') access to, and interaction with, a range of internal and external applications and information sources. Uses of a portal may include improved access to information, increased collaboration, greater use of existing applications and effective integration between applications".

When describing a portal that belongs to organisations that are not corporate in nature, such as an academic institution or a government department, the term campus portal or institutional portal has been used (van Brakel, 2003). The campus portal was first introduced by the University of California in Los Angeles (UCLA) in 1999 and followed by the University of Washington and the University of Buffalo (Moskowitz, 2001). Early in the development of campus portals, under the auspices of the Java in Administration Special Interest Group (JA-SIG), several universities joined together to develop a common portal reference framework called uPortal (Gleason, 2001). The objective of uPortal was to provide a general framework and a set of channel standards to which commercial vendors and application developers could write a standard, one-time only interface (Gleason, 2001). The framework specified requirements such as: a single sign-on; access to various information and services via a single graphical interface; an integrated framework for all campus and business applications; a one-stop facility for all business transactions; and customised and personalised services.

Since the widespread adoption of portals among HE institutions, several researchers have developed more specialised portals to meet specific purposes. For example, Pienaar (2003) reported on the design and development of an academic portal to support the personal knowledge management of academics, Devedzic (2005) described the experience of a research group in developing a knowledge portal, and Jones et al. (2006) demonstrated the development of a university knowledge portal. Based on the above discussion, the postgraduate portal developed in the current research can be categorised as a specialised portal, based on the campus portal concept.

The classifications of portals

There are a number of classifications of portals in the literature. According to Strauss (2002) there are two types of portals: horizontal portals and vertical portals. A horizontal portal is "a public (w)eb site that attempts to provide its users with all the services they might need" (Strauss, 2002, p. 35). MyYahoo (Yahoo Inc., 2006) and MyNetscape (Netscape, 2006) are examples of horizontal portals. They usually include channels for news, email, weather, finance, chat, horoscopes and search engines. A vertical portal is a portal that "delivers organization-specific content oriented toward a topic or a segment of a population or a specific audience … and all the information needs related to that segment" (Maltz, 2005, p. 6). This type of portal intends to address the needs of a user population with specific

relationships to the organisations. Example includes CNET.com (shopping mall), animalhouse.com (college), MP3.com (music), pets.com (pets), and a portal provided by higher education institutions to their staff and students.

The second classification is based on the environments within which a portal operates (Dias, 2001). According to this perspective, portals are categorised as public or private portals. A public portal can be called an Internet portal (Dias, 2001) or a general portal (Collins, 2001). The purpose of the public portal is similar to those of television, radio and newspapers, that is to gain a large number of people as subscribers and return back to use the portals as much as possible (Reynolds and Koulopoulos, 1999; Dias, 2001). The public portals typically offer general-purpose services such as featured contents, varied hyperlinks, e-mail, forums, search capability, news, stock quotes and customisation based on user locale. Some renowned examples of the public portal are American Online.com (AOL), MSN.com and CNN.com (Pienaar, 2003). A private portal is an Intranet or an enterprise portal. This portal is a series of organisation-private websites that tends to display and supply business-specific information, in a certain context, enabling users to find the information they need to face their competitors (Reynolds and Koulopoulos, 1999). According to Devedzic (2005), information security and group support and administration issues are more important for enterprise portals. For example, access to certain company documents may be restricted to certain individuals or project teams on a ‘need to know’ basis (Mitchell, 2004).

Based on the discussion above, this thesis argues that a public portal is a subset of horizontal portals and an enterprise portal is a subset of vertical portals. To conclude this section, it seems that the postgraduate portal developed in this research can be described as a combination of horizontal and vertical portals. The horizontal part consists of information on a broad array of subjects that could be used by research students such as information on pre-registration, registration through to the final year whilst the vertical part includes information on single or closely related subjects or information communicated to a particular group of users, in this case resources on research information (Looney and Lyman, 2000). Therefore, the postgraduate portal can be placed within the overall portal classification, as shown in figure 10.

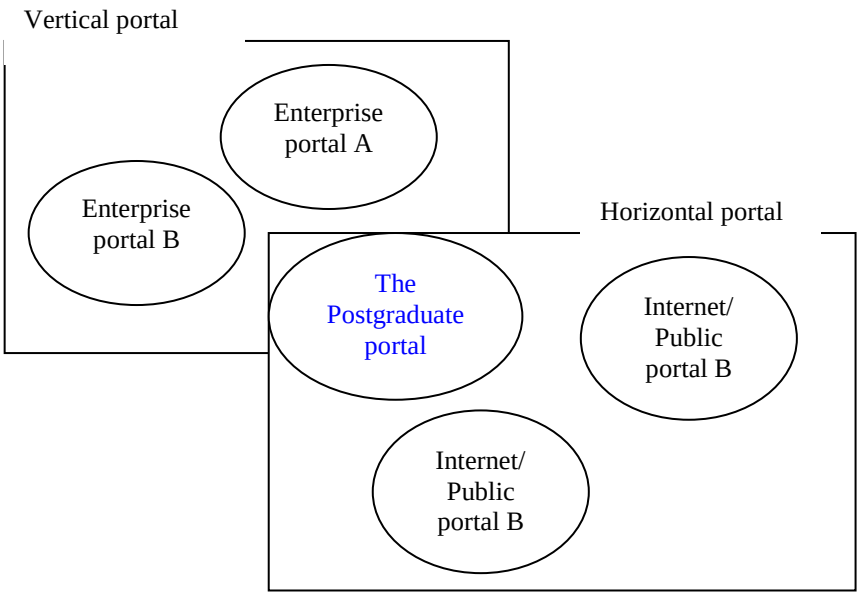


Figure 10 – Positioning of the postgraduate portal

The portal features and functionalities

This section will identify what appear to be the major critical characteristics of portals discussed in the literature and applicable to all types of portals within HE institutions. It is essential that the characteristics and functions described will be able to distinguish a portal from a general website.

A number of researchers have attempted to identify the characteristics of a portal. Aneja et al. (2000) for example, proposed a corporate portal framework (figure 11) which showed the wide-range of characteristics and functions of a corporate portal.

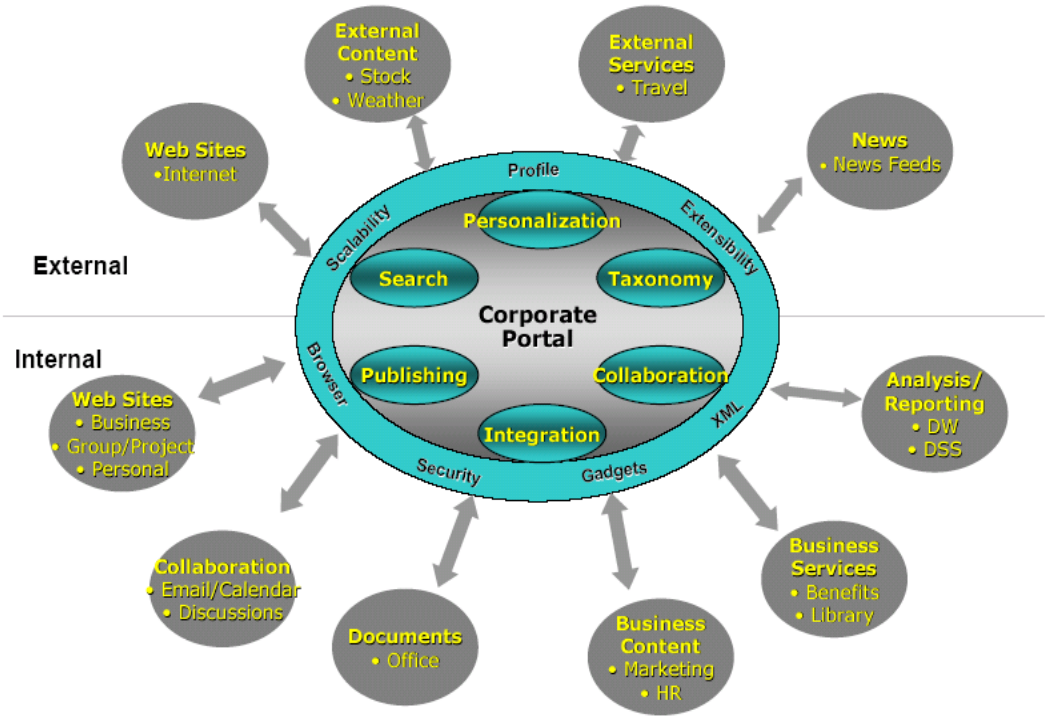


Figure 11 – Corporate portal framework (Aneja *et al.*, 2000, p. 3)

Later, Raol et al. (2002) adopted their framework and proposed two classifications of corporate portal functions: (a) established; and (b) new or minor functions. Raol et al. (2002) reported that established functions were those functions found in at least 75 percent of corporate portal software and new functions were those found in less than 50 percent of corporate portal software. Figure 12 shows that only one function is classified as new and the remaining functions are classified as established in the two-tier schematic model.

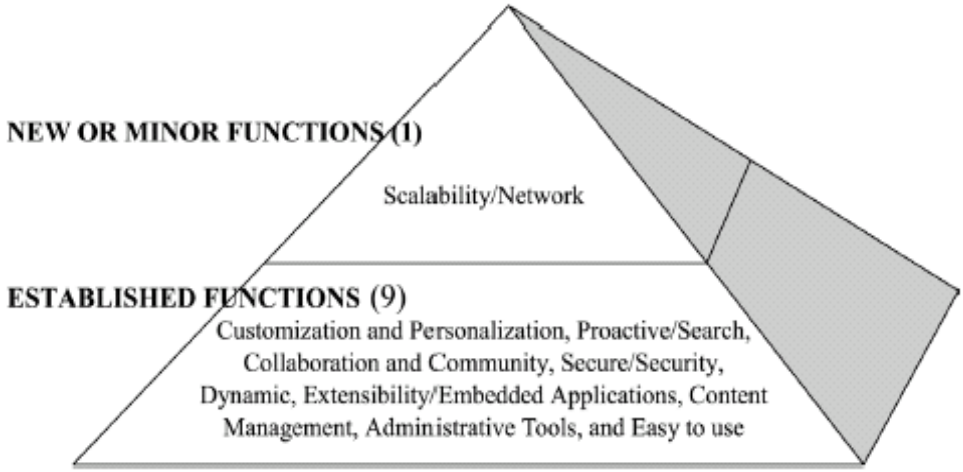


Figure 12 – Schematic classification of corporate portal functions (Raol *et al.*, 2002, p. 398)

In addition to the Aneja et al. (2000) and Raol et al. (2002) frameworks, some market analysts also have published papers and reports on the key characteristics of corporate portals to assist top managers in choosing the right portals for their enterprise (Dias, 2001). For example, Eckerson (1999a) proposed 15 main characteristics of a corporate portal, as shown in table 7.

Characteristics	Description
Easy to use	Users should easily locate and access the right information, with minimum training, wherever the information is stored. Finding business information through the portal should be as simple as using a web browser.
Intuitive classification and searching	The portal should be able to index and organize the corporate information. Its search engine should refine and filter information, support Boolean operators and keywords, and present the search results in intuitive categories.
Collaborative information sharing	The portal should allow users to publish, share and receive information from other users. When publishing into the corporate repository, the user should be able to specify which users and groups may access his documents/objects.
Universal connectivity to information resources	The portal should provide wide access to every information resource, and connect to heterogeneous systems, such as e-mail, databases, document management systems, web servers, groupware, audio and video systems. It must be able to manage different formats of structured and unstructured data.
Dynamic access to information resources	The portal should allow dynamic access to information and objects created by business intelligence and document management systems. It should always provide up-to-date information.
Intelligent routing	The portal should be able to distribute automatically reports and documents to selected users.
Integrated business intelligence tool	To fulfil user information needs, the portal should integrate search, report and analysis capabilities in its business intelligence component.
Server-based architecture	In order to support a great number of users, high volumes of information, simultaneous services and sessions, and the portal should be based on client server architecture.
Distributed services	For load-balancing purposes, the portal should distribute its application services across multiple computers or servers.
Flexible permission granting	Portal administrators should be able to define permissions for users and groups within the company, through flexible user profiles.
External interfaces	The portal should be able to communicate with other applications and systems.
Programmatic interfaces	The portal should also provide a programmatic interfaces (API - Application-Programming Interface) in order to be ‘‘callable’’ from other applications.
Security	For security purposes, the portal must support cryptography, authentication, firewalls, etc. to safeguard corporate information and prevent unauthorized access.
Easy deployment and maintenance	The portal should provide an easy and centralized way to manage all corporate information and to monitor portals’ functioning. It should be easy to install, configure, and maintain.
Customisation and personalisation	Administrators should be able to customise the portal according to enterprise polices and expectations. It should be allowed that individual users personalise their interfaces as well.

Table 7 – Major characteristics of a corporate portal (W. Eckerson, 1999a; Dias, 2001)

Based on the corporate portal frameworks literature, the common features and functions of the campus portal will be discussed in more detail.

Customisation

Although customisation and personalisation are often used interchangeably in the corporate portal literature (Coner, 2003), in this thesis, customisation is viewed as a 'supply-side function' (Scheepers, 2006) that has the facilities to enable providers to tailor contents for specific portal users or communities in line with their unique needs (van Brakel, 2003). In general, through customisation, every user will see a different initial portal page. Based on each user's roles, responsibilities, workflow, and the information that the user is authorised to access, the customisation engine will determine appropriate information to display (Strauss, 2002).

Personalisation

Personalisation refers to demand-side activities (Scheepers, 2006), which not only have facilities that enable individual users to set specific preferences in terms of their own portal access, but also has the facilities that enable the system to use such information to dynamically deliver specific content to users (Benbya *et al.*, 2004). One architectural component used in personalising the portal is that of personal profiles. These profiles store user information and preferences gathered through existing databases or manually entered by users. Since users' preferences evolve and change, a mechanism for automatic profiling is desirable. In addition, a feature that enables users to modify and update their profile data is also useful (Aneja *et al.*, 2000).

A Single Point of Authentication and Access

This feature is considered to be one of the most important features of a portal. A secure single sign-on will enable users to gain seamless access to all information resources and services that are supported by different application systems (Gleason, 2001). Once signed on, a user should be presented with content channels, information and functionalities subscribed by and related to that user.

The single sign-on system operates in a way that allows a user to authenticate only once to a centralised security system which manages the user's password for other applications within the portal (Sullivan, 2004). For instance, a student may log into a single sign-on server through the portal and navigate to a VLE system. The VLE system has its own access control mechanism and requires the student to log in. When the VLE system asks the student for

credentials, the single sign-on server intercepts and provides the student's credentials to the application. The student is then granted access to VLE system without having to remember another username and password.

Search Engine

A portal should provide a search engine that will enable users to navigate quickly to the information they need (W. Eckerson, 1999a; Aneja *et al.*, 2000; Dias, 2001; M. A. Smith, 2004).

Categorisation of Content

Since a massive volume of information is available on the portal, it is critical that the contents are organised and indexed into category and sub-categories (Aneja *et al.*, 2000). By categorising contents, the portal provides users with a navigation directory that can be browsed to find specific information.

Applications Integration and Extensibility

A portal should present a unified view of institutional information that integrates information from different institutional repositories, instead of having institutional information spread across many sources within the institution. In addition to information resources, a portal should also have the ability to integrate existing web-based applications and services of an institution. Moreover, a portal should also have an extensibility feature since the development of a portal is an ongoing process. New modules might be developed and need to be appended into the system. Furthermore, advances in portal technologies and new applications may reach the sight of the development teams and offer great improvement to the existing system (W. Eckerson, 1999a; Dias, 2001; Raol *et al.*, 2002).

Balance of Push and Pull Information

Shilakes and Tylman (1998) argued that institutions would need to use both 'push' and 'pull' content to ensure that the right information is available or disseminated to the right users at the right time. 'Pushed' information refers to content that is sent to authorised users on a regular, pre-selected basis. It includes news, coming events, specialised memos or recently published research contents. 'Pulled' information refers to user-defined and relevant academic contents which are made available through a search engine (van Brakel, 2003).

Collaboration

Collaboration tools such as e-mail, threaded discussions, chat and bulletin board software should be available to let people who have the same interests communicate and share information (W. Eckerson, 1999a; Raol *et al.*, 2002; van Brakel, 2003).

Security

Security is the most concerning issue among users who log into a portal. In order to protect privacy, the portal should provide some kind of security measures to ensure that only authorised users can access to their account and personal information (W. Eckerson, 1999a; White, 1999; Dias, 2001).

Easy to use

Ease of use is one of the features that will influence the users' adoption and continuation of use of an information system. Therefore, it is essential that a portal should be easy to use by every user (Raol *et al.*, 2002).

At this point, it is important to note that in this thesis, the VLE is considered as part of the generic information infrastructure – the web portal. The focus of this thesis is on the design of the generic information infrastructure in which VLE is the important subsystem that could provide support throughout the stages of the life-cycle of postgraduate research programme.

2.2.5 *Summary of web-based technologies*

The discussion in the previous sub-sections concerned with various web-based technologies that are relevant in providing appropriate information infrastructure to support research students. The sections also detailed the required features of various web-based technologies in facilitating research process. Table 8 sets out a summary of this discussion.

Technology	Relevant to information infrastructure	Additional Features for research process
VLE	• Widely adopted by higher education institutions • Were used to support coursework-based students	• Personalisation function • Community building functions • Functions to support research study throughout.
VRE	• Not directly relevant to teaching and learning but relevant to supporting research process	• The main purpose was to support the research processes of experienced academics and scholars
Portal	• The ability to integrate other educational systems together • Contains features that are relevant to support open learning of research study	• Web 2.0 tools
Web 2.0	• Provide relevant social tools to support research process	

Table 8 – Summary of web-based technologies features

In the following section, this thesis examines the web-based applications that facilitate the process of general process of research and doctoral research process.

2.3 Web-Based Applications in Facilitating Research Process

In the previous section, this thesis examined various web-based technologies and broadly discussed their features and functions. This section now investigates the development and use of these web-based applications and other web-based technologies in the higher education setting that have been deployed to support the research processes. The purpose is to provide evidences of the relevancy of these tools to be consider

Overall, there are limited studies that look at the use of technology to support the research processes. Of these studies, some focused on the use of web-based applications to support general processes of research such as Chong (2010), Lopez Alonso et al. (2008), Cold (2006) and Sauer et al. (2005) while others have concentrated on the use of web-based applications to support the processes of doctoral research such as Mortensen and Walker (2002), Rockinson-Szapkiw (2011), Thomson and Allan (2010), Espinoza-Ramos and Hammond (2008), Joyes and Banks (2008), Lotia and Teasley (2005), Carmichael and Burchmore (2010) and Martin and Woods (2008).

2.3.1 *Supporting general processes of research*

The general processes of research includes the activities involved in the production of research papers (Cold, 2006; López Alonso *et al.*, 2008; Chong, 2010) as well as activities or tasks involved in academic research (Sauer *et al.*, 2005).

Lopez Alonso et al. (2008) conducted experiments to test the effectiveness of a socio-constructivist Virtual Learning Environment (VLE) in developing competences in learning to research. They define learning to research as:

> "embarking on the process of systematic learning in order to increase (one) knowledge in a specific area (in which) it involves (i) the selection, organisation and processing of existing information (ii) the choice of adequate analysis strategies and (iii) the efficient management of information and time, both at individual and in group level" (López Alonso *et al.*, 2008, p. 877).

The learning to research design includes eight stages spread through three different phases as shown in figure 13.

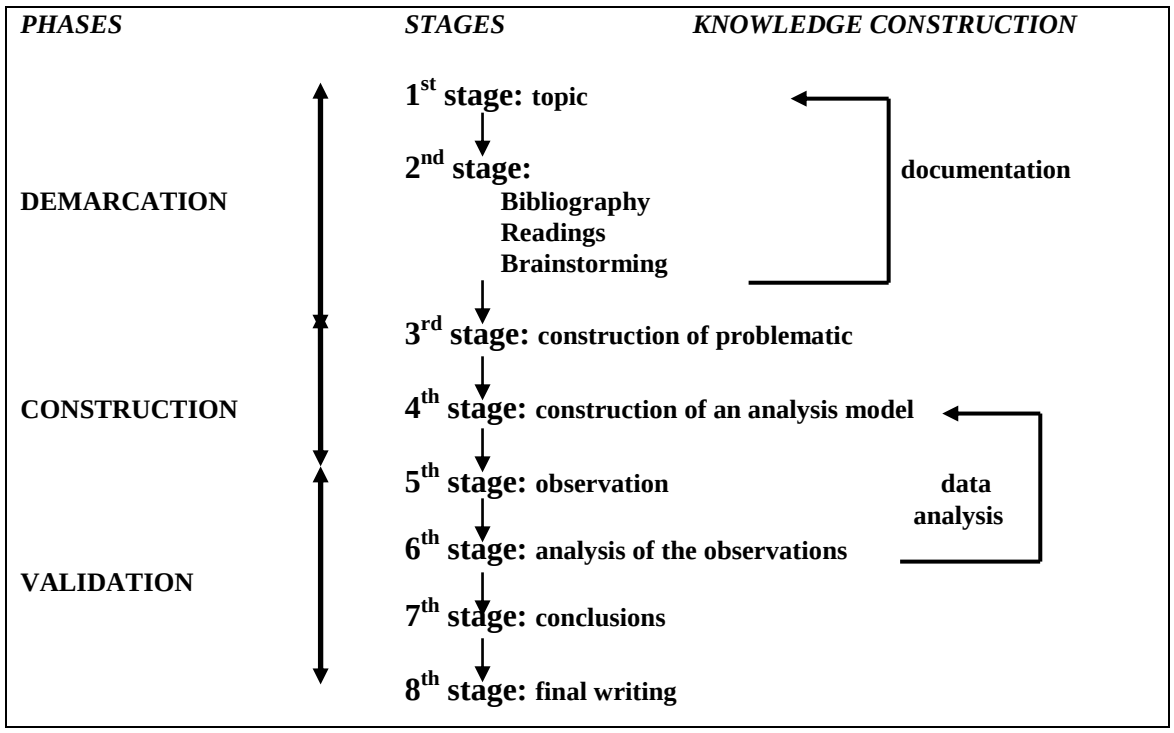


Figure 13 – The learning design (López Alonso *et al.*, 2008)

Two experiments were conducted, the first of which was to test whether student learning was better in the socio-constructivist VLE as compared to in the individual constructivist VLE

learning environment, while the second experiment tested whether student learning was better in the socio-constructivist VLE as compared to the behaviourist learning experience in the face to face learning environment. Students in both socio-constructivist and individual-constructivist groups were supported with VLE tools. However, only students in the socio-constructivist group were asked to work collaboratively to produce the assigned work. In contrast, students in the behaviourist learning group worked individually to produce the assigned task from the material provided and explained by the teacher. Student learning was assessed through a post-test on knowledge acquired after the learning experiment with only stage four of Phase two - construction of an analysis model - from the learning design was tested in the experiments. The findings revealed that activities performed in the socio-constructivist VLE are more effective than both individual constructivist VLEs and the face to face behaviourist learning environment.

In general, this study confirms the findings of Harasim (1990), namely that an online setting is an effective environment to support collaborative learning. However, as have been cautioned, there should be repetitive experiments of this kind to confirm the results, as the sample size was small and only one of the phases within the learning design was tested in the experiments.

Despite the fact that Cold's (2006) and Sauer et al.'s (2005) work were not particularly focused on developing or using web-based technologies, their work provide supporting arguments toward the use Web 2.0 tools to support the processes of research. Cold (2006) discussed the potential of RSS to be used to support both individual and group research. He claimed that RSS can be used by research students to glean current information from online journals, publications, weblogs and other sources without visiting the sites daily. By contrast, Sauer et al. (2005) recommended that members of a research team should use weblog and wikis for sharing knowledge simply and quickly. Similar to Sauer et al. (2005)'s study, Chong (2010) also used weblogs as a knowledge sharing tool in his study. More specifically, Chong (2010)'s study utilised weblogs to enhance the initiation of students into academic research. He argued that the interactivity and feedback features of blogging enhance the process of traditional supervision by allowing close monitoring and timely feedback. Furthermore, blogging combines solitary reflection and social interaction to support the development of research capabilities through collaboration. These studies reveal the potential of web-based technologies particularly web 2.0 and demonstrate how each has been deployed to support the

processes of research. The next section examines studies that focus on using web-based technologies to support the processes of doctoral research.

The studies that discuss the used of web-based technologies to support the general processes of research are summarised in table 9.

Authors	Web-based application used	Study Origin
Lopez Alonso et al. (2008)	• Use VLE to support taught courses subjects of "learning to research" • The VLE was used both to support social- and individual constructivist learning model • Result show learning is more effective in social constructivist VLE than learning in individual VLE	Spain
Cold (2006)	• Discuss how RSS can be used to support research students by providing a mechanism to glean current information from on-line journals, publications, web logs and other sources without visiting the sites daily	Not mention
Chong (2010)	• Use weblog to enhance student initiation to research • supporting undergraduate students' research paper	Singapore
Sauer et al. (2005)	• Use weblog and wikis as tools for communication • Weblog can be used to substitute manuals for daily lab work for research group	Not mention

Table 9 – Supporting general processes of research

2.3.2 *Supporting doctoral research learning*

The literature shows that investigations on the use of web-based technologies to support research students have been undertaken from different parts of the world and from a wide range of perspectives. There are four studies originating from the UK, four studies from the USA, one from Norway and one from Ireland. Since the structure of UK and Europe doctoral programmes is different from ones in the US, this section discusses the studies separately. However, the discussion of the similarities and differences among the focus of the studies will be compared and contrasted where appropriate.

UK-, European- and Australian-based Studies

Studies originating from the UK and Europe looked at various ways in which web-based technologies could be used to support the activities and tasks involved in research degree programs. For example, some studies investigated how web-based technologies could be used to provide online resources for generic research skills training, whilst others focused more on the suitability of the technologies to support collaboration and networking activities.

There is well-established literature on the importance of collaborative learning and

networking in the doctoral research program (Hasrati, 2005; Malfroy, 2005; Parker, 2009). However, studies show that students still reported isolation as one of the problems they face during their doctoral studies (Ali and Kohun, 2006). In addressing this problem, Espinoza (2007; 2008) conducted an action research study to explore the potential of ICT developments such as websites, online forums, web log, pod casts and video clips in promoting the formation of community of practice through collaboration. Preliminary findings of the study indicate that even though all students were aware of the benefits of interaction and discussion, many do not take advantage of the facilities offered. However, the author noted that students were separately engaged with each other face-to-face and electronically through other ICT development called the 'Graduate Association'.

Other initiatives to promote collaboration amongst doctoral research students through the formation of communities of practice were undertaken by Joyes and Banks (2008) and Thomson and Allan (2010). Instead of exploring current available ICT tools, Joyes and Banks (2008) used video research narratives that captured a wide range of academic staff and students' experiences, case studies and expert views as pedagogic devices. The evaluation data showed that the video narratives were well received by both students and early career researchers. However, the authors reported that there were no communities of practice formed (Banks *et al.*, 2008). A similar approach to building online communities of practice was also undertaken by Thomson and Allan (2010). They developed a Graduate Virtual Research Environment (GVRE) where video reflections based on the experiences of students and staffs were seeded to foster sharing and learning among postgraduate research students. Their initial findings on the impact of the GVRE on students learning indicated positive feedback on the video and other resources within GVRE. However, networking still remains an issue. Students were reported to prefer physical interaction for collaboration and networking.

Looking at the above cases discussed, it seems that the problem of forming online community of practice lies on the approach rather than the technologies used. In their study of commencing and completing PhD students in an Australian university, Martin and Woods (2008) found that students' needs to engage with learning community varied according to the nature and stage of their research. The kind of community that commencing students appeared to need was the one that could help overcome the feeling of isolation whilst completing students wanted something that was as "individual as it is professional" type of community (Martin and Woods, 2008, p. 143-144). In order to accommodate the students' needs, the

authors provided guided facilitation and synchronous and asynchronous discussion forums for the commencing students with blogs and online profiles for completing students. These findings suggest that it is best to match the type of web-based technologies with the students' needs at particular stages of their research, to encourage the maximum impact of technologies on students' networking and learning.

The system of doctoral education and training has undergone major changes (Burton, 2003). Park (2005a) argued that the emphasis of doctoral education should not wholly rely upon the production of new knowledge but also on the acquisition of transferable skills. As a result, there have been some investigations into ways of providing online support for research skills training. Espinoza (2007; 2008), Joyes and Banks (2008) and Thomson and Alan (2010) developed online resources such as websites with mixture of resources, video narrative and video clips respectively in their initiatives to support the research training skills. Lawlor and Donelly (2010) on the other hand explore the potential of Web 2.0 tools in supporting research skills training. Specifically, they conducted a survey to determine the subjective preference of 15 first-year science and engineering PhD research students towards seven alternative podcast formats for communication skills development. Podcasts were formatted into a typed transcription, original presentation slides, a full video recording, a full audio recording, presentation slides with embedded speech, a re-enacted video and a re-enacted screencast by a member of academic staff. The survey data revealed that 13 out of 15 students ranked the slides with embedded speech as their top three preferred format. This study showed the potential of an audio podcast embedded into associated lecture slides to support the development of research students' generic skills training. This study also showed the importance of eliciting student preferences towards the online resources chosen to support them.

Carmichael and Burchmore (2010) explored the potential of Web 2.0 technologies in supporting postgraduate research through a participatory design, development and evaluation process. The study was part of a funded research and development project entitled 'A Social and Professional Network for Early Career Researchers in Education' or 'Spinnaker'. Two groups of postgraduate research students took part in project seminars. These seminars involved a series of activities in which discussion of the aims, theoretical background and technological objectives of Spinnaker project; discussion of the key issues in postgraduate research; exploration of the potential of Web 2.0 technologies to support postgraduate

research activities took place. The first group consisted of thirteen students from different disciplinary and professional backgrounds who were linked to projects funded under the UK's Technology Enhanced Learning Research Programme. The second group comprised eleven postgraduate research students working on a wide range of educational research projects set in schools, higher education, community education and workplace learning. These students' research was frequently directly related to the development of practice in their own workplace. In general, the outcomes of the design process were several recommendations on how features of Web 2.0 could be used to support postgraduate research training and research practice including representation of self and personal contacts, personal record keeping, access to information, building on the work of others, integration of data from multiple sources, integration of widely heterogeneous data and 'mashups' and supporting workflow and sequences of events. The authors claimed that a wide range of the ideas envisage in the Spinnaker project were realised through the development of the Sakai virtual collaboration environment led by researchers from the University of Cambridge's Centre for Applied Research in Educational Technologies. Table 10 summarised the studies.

Authors	Web-based application used	Processes/activities supported
Espinoza-Ramos and Hammond (2008)	• Investigated the potential of websites, online forums, weblog, podcast and video clips in promoting community of practice.	• Provided research training materials, research seminar resources, support material for progression and study skills through a websites • Also provide support forums
Joyes and Banks (2008)	• Investigated the use of video narratives as pedagogic device which were provided through the Virtual Resources for Online Research Training Website (V-ResORT)	• The video narratives captured researcher experiences, case studies and expert views on topics such as methodology, research skills and research design
Thomson and Allan (2010)	• Developed and study the impact of a Graduate Virtual Research Environment (GVRE) on the learning and networking experience of research students	• The GVRE provided reflective video narratives based on students and staff experiences, online discussion and social networking tools
Martin and Woods (2008)	• Networking tools for commencing students include guided facilitation, synchronous and asynchronous discussion forum • Networking tools for completing students include blogs and online profile	• Support student at the beginning and completing stage of the doctoral research
Lawlor and Donnely (2010)	• Explored the potential of Web 2.0 tools in supporting research skills training	• Used podcast to deliver video of speaker about communication skills
Carmichael and Burchmore (2010)	• Discussed how research students participated in developing Web 2.0 tools to support research practices.	• Networking • Sources for research methods in education • RSS feed

Table 10 – Summary of research on Web-based applications and doctoral research

US-based Studies

Studies originating from the US have focused on supporting students at both the taught and dissertation phases thus, reflecting the structure of the US doctorate (John W. Creswell and Miller, 1997). For example, Rockinson-Szapkiw (2011) and Lotia and Teasley (2005) reported a study on using technology to support the dissertation process while Meyer (2010) and Jae Hoon et al. (2008) discussed the use of web-based technology to support the taught component of a doctoral degree, namely an online doctoral level course and an online research methods course respectively. Only Lotia and Teasley's (2005) work used web-based technologies to support campus-based students, while Rockinson-Szapkiw (2011), Meyer (2010) and Jae Hoon et al. (2008) focused their investigation on supporting distance students or fully online courses.

Rockinson-Szapkiw (2011) examined the use of SharePoint as a collaborative workspace for supporting the dissertation process. The SharePoint site comprised of four portals namely: (a) "The dissertation portal" which provides dissertation resources and links as well as several discussion forums; (b) "The chair availability portal" listed all potential dissertation chairs available to chair dissertations; (c) "The candidate research showcase" is a place where students can showcase their work and their progress; and (d) "My dissertation portal" is a place to store and share documents with committee members and the chair. In this study, she looked at students' perceptions toward e-learning and the extent of SharePoint in facilitating student to student and student to instructor connection. Survey results from 92 doctoral candidates enrolled in the dissertation process in an online Ed. D. program; indicated that the use of SharePoint to share documents and to facilitate ongoing discourse among doctoral candidates, their peers and their committees resulted in increased student-to-student and student-to-instructor connection when compared with traditional dissertation communication methods such as email. Furthermore, students reported medium to high levels of satisfaction in using SharePoint to facilitate the dissertation process.

The approach taken by Lotia and Teasley (2005) to investigate the applicability of web-based technologies to support the dissertation process was quite different from that of Rockinson-Szapkiw (2011). Instead of utilising currently available web-based tools, Lotia and Teasley (2005) developed a workflow tool based on the findings of their investigation into the nature of the dissertation process and the relevant roles played by students, academics and administrative staff. The workflow tool called the Dissertation Checklist can be used by both academic and administrative staff, as well as students, to view official milestones, requirements and recommendations as well as to track the students' progress. It was integrated into the existing Collaboration and Learning Environment called Grad Tools. Other features of Grad Tools that helped support students during their doctoral study included file storage, threaded discussion and an email service.

In common with Chong (2010), Cold (2006), Sauer et al. (2005) and Meyer (2010) also explored the use and effectiveness of Web 2.0 tools such as wikis, blogs and online discussion tools to support an online doctoral level course on higher education finance. The findings revealed that the level of learning achieved depended less on the tools used than on the nature of assignment. As for this study, the type of questions asked reflected the level of learning

expected from the students. Therefore, the findings on the level of students' learning indicated the expected learning. For example the first two questions were directed to the 'know' and 'understand' level of the Bloom's taxonomy. As a result, students' level of learning for these questions indicated the 'know' and 'understand' level.

Besides Meyer (2010) and Lim et al., (2008) also focused on the use of web-based technologies to support a doctoral level course. However, rather than examining the students' level of learning, they explored the experience of a group of students who had taken online research method courses which were delivered using the Blackboard VLE. The findings revealed that the fully online format may be more suitable for certain types of research method courses, based on the nature of the objectives of the course. Furthermore, fully online research method courses may not be preferable to some students, whilst they may offer the venues and opportunities for other students to build a networking and learning community. Table 11 sets out a summary.

Authors	Web-based application used	Processes/activities supported
Rockinson-Szapkiw (2011)	• Investigated the use of SharePoint used as a collaborative workspace	• Supported the dissertation stage of the doctoral research degree • Provided discussion forums, lists of dissertation chairs, a place to showcase students' work and a place to store and share documents with dissertation community
Lotia and Teasley (2005)	• Developed a workflow system for dissertation research – the Dissertation Checklist	• The Checklist provided official milestones, requirements and recommendations and student's progress
Meyer (2010)	• This paper compares the level of student learning that use Web 2.0 tools with the level of student learning without Web 2.0 support. • Uses wikis, weblogs and online discussion	• Support a doctoral level course
Lim et al. (2008)	• Investigated the learning experiences of doctoral students in fully online research method courses • Research methods courses support by BlackBoard VLE	• Supported research method courses

Table 11 – Summary of studies on Web-based applications and doctoral research

2.4 Discussion

The literature review on the application of web-based technologies to support postgraduate

students has revealed a number of gaps and opportunities that should be addressed. Several gaps were identified such as:

i. Personalisation

Given that the individualised nature of postgraduate research and the research journey, it is likely that students will want to access to flexible resources with the option of working through them via a personalised route. However, as discussed in the previous sections, the system or applications being developed in the previous studies do not focus on providing a personalised route to students. Therefore, in addition to other features of online support, there is a need to develop an information infrastructure that takes personalisation features into consideration.

ii. Integration of tools

A postgraduate research program involves various stages of the research process as well as tasks and activities. The studies reviewed in the previous sections however, implement online support that focus on part of the research processes or activities. For example, Joyes and Banks' (2008) and Thomson and Alan's (2010) studies only focus on providing support for collaborative learning and research training whilst Carmichael and Burchmore's (2010) study only centred on supporting research skills training. On the other side of the Atlantic, such cases also prevail. For example, Lotia and Teasley (2005) focused on providing support to dissertation process whilst Meyer (2010) concentrated on online support during the first stage of the US doctoral process. Therefore, there is a need to design and develop an information infrastructure that integrates these online tools in order to provide well-rounded support for postgraduate research students.

iii. Support throughout the research process

It was demonstrated in Martin and Woods' (2008) study that students needs change according to the nature of their study and the stage of their research. However, their study only focused on commencing and completing research students. What about support for research students in the middle stages of research? These issues were not addressed in previous studies. Therefore, a more holistic approach in terms of supporting research students throughout the stages of the research life cycle should be designed.

Several opportunities were also identified such as:

i. Web 2.0 tools

The potential of Web 2.0 tools for supporting tasks and research activities were well established in the previous literature review sections. The integration of these Web 2.0 tools in the information infrastructure to support postgraduate research should be taken into consideration.

ii. *Research skills training and administrative support*

The majority of studies reviewed revealed that online resources to support the research skills training were broadly welcomed. These findings demonstrate the feasibility of online tools in supporting skills training and therefore should be taken into consideration in the design of an information infrastructure for supporting postgraduate students. One interesting point raised in the preceding sections is the inclusion of online support for administrative tasks illustrated by Lotia and Teasley's (2005) study which was lacking in most studies reviewed except those by Espinoza (2007; 2008).

iii. *Blended learning*

Espinoza's (2007; 2008), Joyes and Banks' (2008) and Thomson and Alan's (2010) findings revealed that some research processes were suited to be supported through providing online resources whilst others were more suited to being supported offline. These findings suggest that blending the best of face-to-face settings, such as traditional collaborative learning through research seminars and workshops, and the best online support, such as providing online resources through an information infrastructure for research skills training and administrative tasks, could be the best way forward for supporting postgraduate research students.

iv. *Bottom up approach*

From a closer examination of all the studies discussed in the preceding sections, it is not difficult to conclude that the best way forward to design an information infrastructure is through a best fit to postgraduate research students' needs and pattern of work.

2.5 Summary

This chapter has explored issues concerning the design of an information infrastructure to support research processes within the higher education institutions. Firstly, the issues in the web portal design and development were discussed. Secondly, the chapter provided an overview of web-based technologies that could be employed to support the research process. Finally, the chapter focused on discussing how web-based technologies have been employed to support the research process.

This chapter has identified gaps in the research in relation to designing an information infrastructure in the research degree context, as discussed in section 2.4. As the gap identified is related to integrating web-based applications in the information infrastructure to supporting research students, the following chapter is dedicated to examining the literature on the research degree. In doing so, it attempts to unfold the standard requirements of research degree and associated students' needs that could inform the design of an information infrastructure to be developed.

Chapter 3. Literature Review: Postgraduate Research in Context

This chapter provides the context in which the empirical work of this research was conducted. It is important to contextualize the study by providing background information on the research degree scene. The focus of this study is on research study at masters and doctoral levels. Since doctoral research, especially PhD research, has received most attention in the literature; a major part of this chapter is dedicated to discussing issues related to PhD that have been debated in the academic literature.

In general, research degrees involve a process of sustained and in-depth study of a specific topic which is examined through a written thesis and oral examination. While some doctorates are conducted in full research, others such as American PhDs and Integrated PhDs have some elements of coursework. For the purpose of the literature review, this chapter begins with an overview of research processes models and proposes a model of research processes to be used in this research. Following section 3.1, a discussion of adult learning theories (Knowles, 1980; Mezirow, 1997) that form the basis for the design of a web portal is provided. Section 3.3 establishes the relationship between adult learning theories, postgraduate research and web-based technologies. Section 3.4 provides the interpretation of the adult learning principles into some design principles for the web portal. Next, section 3.5 introduces the theory of the stages in socialisation development of postgraduate students. Here, the thesis intends to demonstrate the applicability of graduate socialisation theory (Weidman *et al.*, 2001; Gardner, 2008) to inform the design of the web portal. The last section details the requirements of a postgraduate research study.

3.1 Models of Research Processes

As one of the aims of this study was to identify the information requirements of research students at each stage of their study, it was essential to delineate the stages involved, as well as the tasks associated with the research process. Because of the reflective nature of research, one would argue that dividing the research process into stages is an artificial approach (Grix, 2001). However, it is essential to have signposts to give order to a process that will otherwise be difficult to see as a whole during the course of the study.

There are several study guides produced by authors who have proposed models of the research process such as ‘How to Get a PhD’ (Estelle M. Phillips and Pugh, 2005), ‘The

Postgraduate Research Handbook – Succeed with your MA, MPhil, EdD and PhD' (Wisker, 2001) and 'How to Research' (Blaxter *et al.*, 2006). This section reviews three research process models, and based on the review, a research process model that was used in this research is proposed. The models used in this review were selected for several reasons: (i) they list and discuss the stages involved in the research study; (ii) they identify common tasks or activities involved at each stage of the research study; and (iii) they can be applied by students undertaking research degrees.

3.1.1 *Phillips and Pugh model of research process*

The first model was proposed by Phillips and Pugh (2005). In discussing this model, care has been taken in interpreting it, since the authors only include a brief summary of each stage. Furthermore, the book was written based on PhD work that involved research students from a UK university. Therefore, the research process model may be suitable to UK based universities or other institutions that follow UK style research programmes.

The model consists of six stages: identifying the field of interest; finding possible topics; thesis proposal; pilot study; data collection and analysis and final writing up as illustrated in figure 14.

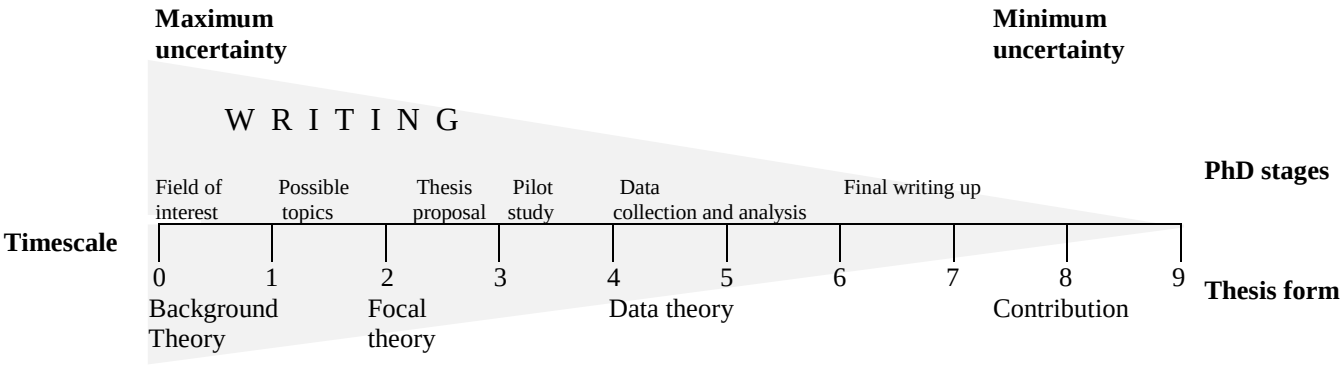


Figure 14 - The PhD process (Estelle M. Phillips and Pugh, 2005)

Based on figure 14, the model not only specifies the stages of research, but also shows the timescales, elements of the thesis and uncertainty levels. It is suggested that as the students go through the process, their level of uncertainty will reduce. The model also allocate some blocks of time each to background theory, focal theory, data theory and contribution that form the overall thesis. The first four stages of the research process are allocated one term each, the

fifth two terms and the last stage three terms. Phillips and Pugh (2005) argue that the model is neither unrealistic nor unachievable since some students are able to follow it. Even if it is common to fall behind, the model can be adapted to suit everybody. The authors also noted that the process is not straightforward, since earlier work may need to be revised or work may have to be done in more than one stage at the same time. The following sections discuss each stage.

Stage 1: Field of interest

The process begins before a student applies to undertake PhD study at a particular university. Generally, a student is asked to complete an application form and a research proposal. The research proposal should specify the area of interest, research questions, context, methods, anticipated outcomes and a study plan. It is suggested that the area of study is of prime interest, since students will have to spend several years studying it.

Stage 2: Possible topics

This stage is concerned with gathering together ideas that are worth researching and researchable within the time available. Phillips and Pugh (2005) suggested that a student should consider two to three topics in some detail so that a realistic professional choice can be made at the next stage. The topics should be worth researching, and researchable in the time available. They also argued that the process of identifying researchable topics is considered as one of key skills in the doctoral learning process.

The topic of research will normally be investigated or chosen at the early stage of research before applying for a PhD study (Wisker, 2001; Blaxter *et al.*, 2006). This is because the topic can be used to match students with supervisors (Wisker, 2001).

Stage 3: Making a thesis proposal (including the design of the investigation)

This stage involves consulting current theories and reviewing the background theories in order to establish a case that the proposal is, indeed, worth researching, and will contribute to the existing body of knowledge.

Stage 4: Pilot Study

The nature of this stage varies across disciplines, and here, some studies test survey instruments, sampling frames or the availability of resources. The main point is to test whether the research will work. It should be pointed out that not all research should have a pilot study.

Stage 5: Data Collection and analysis

The activities in this stage are quite specific to each topic within a discipline. However, good researchers know their data by heart. This means that they not only understand the data, but also "living, eating and sleeping (with it)" (Estelle M. Phillips and Pugh, 2005, p. 90). The reason for having this understanding is that it will give the researchers the ability to see the data from different angles, and in terms of different theories.

Stage 6: Final writing up

Phillips and Pugh (2005) argued that the writing up stage always takes longer than intended. Based on figure 14, the writing up stage is shown to take three terms (or 12 months) full time. A period of writing that is less than two terms (8 months) full time and a year part time would be unrealistic (Estelle M. Phillips and Pugh, 2005).

Overall, the Phillips and Pugh model presents the general steps in the research process. However their model do not show the whole processes involved in PhD research. Their model is quite general, in the sense that other important activities such as choosing a supervisor, methodology and preparing for a viva are not included.

3.1.2 *Blaxter et al. model of research process*

The second model came from Blaxter et al. (2006), and illustrated the processes of research. The book is designed for those undertaking research in the social sciences, education, business studies and health and social care. Therefore, the model may or may not be compatible with the science and engineering field. However, some parts of the model might be useful to them.

The model consists of six key aspects of the research process. The authors view their research process as a spiral, whereby stages can be revisited with different and developed insight as

shown in figure 15. The model shows that research can begin at almost any point; has no ending process; will cause the researcher to reconsider practice and will return the researcher to a different starting place.

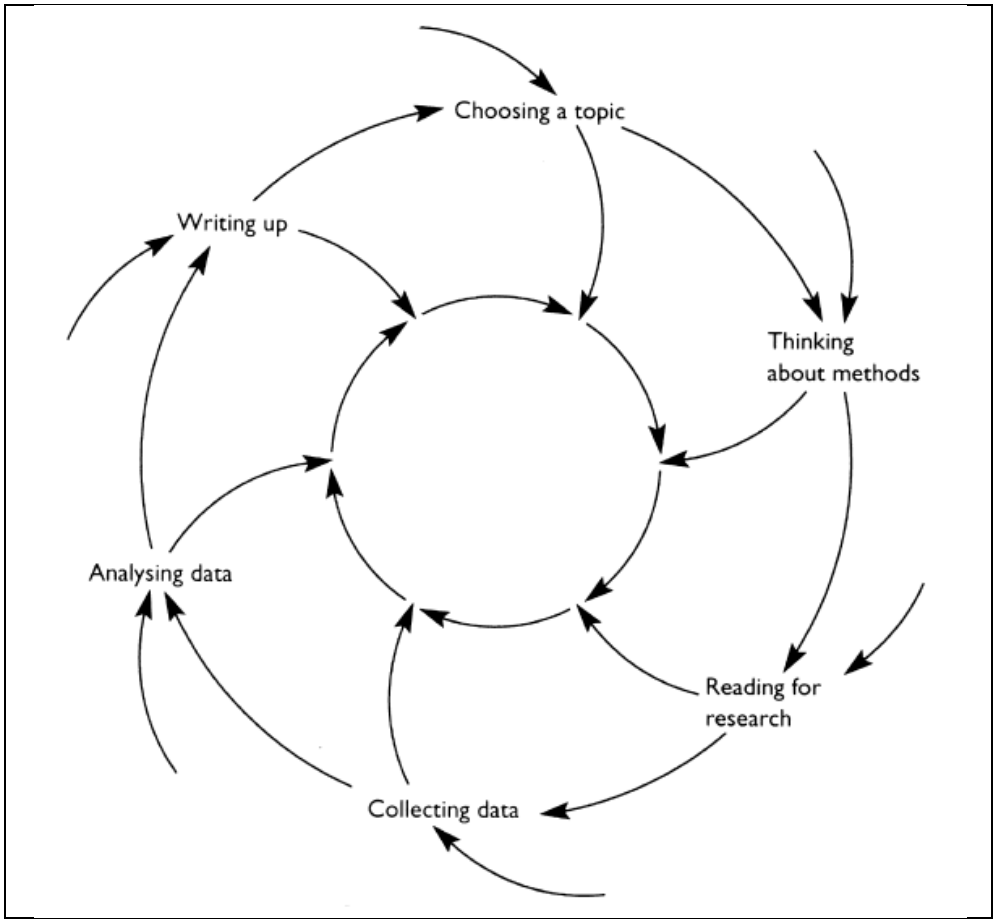


Figure 15 – The research spiral (Blaxter *et al.*, 2006)

One of the main advantages of this model, compared to other research process models, is that it is flexible, because it allows researchers to revisit any of the research stages. Nonetheless, it may not be appropriate for research students. According to this model, the research will not be completed. Rather, all research students need to complete their research within the time specified.

The authors noted that the nature of the cycle differs between research designs. For most quantitative research projects, the types of analysis required might be determined before any fieldwork or data collection is conducted. This is because the decisions about the type of statistical analysis depend upon the types of data collected. However, for qualitative research, data collection, sorting, analysing and reading can be taken simultaneously. The view that research can begin at almost any point may not be suitable for those new to research. For

example, without any research topic or field, it will be difficult for new research students to start writing up. Typically, a research project begins by identifying and formulating research problems (Berg, 2004).

The authors believe that everyone has different skills, resources and knowledge gained from education and life experience so far. Therefore, they suggest that a researcher takes an audit which helps to determine the level of skills, knowledge and resources. Consequently, it enables a researcher to identify the gap between the current level and the level required for successful completion of the research, and is in effect a personal development plan. This exercise not only benefits the first time researcher, but also an experienced researcher, as it helps to recognise the current level of valuable skills, knowledge and resources, as well as to plan for the required learning needs and resources in the immediate future, and longer term.

The authors placed choosing a topic and supervisors under the 'Getting started' chapter. They argued that once a person has decided to do something, he or she has started a research project. In this stage, choosing a topic or a research area involves considering the size of the topic, the cost and the time as well as the resources available for the research. Once a topic is chosen, it needs to be refined and focused upon. The reason is not only to ensure that it is relevant, but also to produce a project that is feasible within time, space, costs and other resources. The authors have argued that identifying research questions or hypotheses, defining concepts, issues and contexts as well as developing a research proposal are all activities involved in providing a clearer focus for the research idea. As for finding and choosing a research supervisor, the authors listed criteria to look for when choosing a supervisor. A criterion highly recommended for a successful supervisor-researcher relationship is that both researcher and supervisor are committed to the researcher successfully completing the research.

The next step in the Blaxter et al.'s (2006) research process is that of 'thinking about research methods'. In this stage, the authors suggested that researchers should be aware of everyday skills that they already possessed as these skills can be applied in their research. These skills include reading, listening, watching, choosing, questioning, summarising, organising, writing, presenting and reflecting. Next, the authors proposed that researchers think about research philosophy and design, as the paradigm they choose determines the most appropriate methods for their research. Other alternative ways of thinking about research methods are to classify

general strategies into qualitative or quantitative, deskwork or fieldwork; approaches into action research, case study, experiments, and survey; and techniques into documents, interviews, observations and questionnaires.

It is common in the research process (Wisker, 2001; Bell, 2006) that after deciding on the topic, a researcher will read the literature on the subject, so as to identify gaps in the literature that can be addressed by the research questions before thinking or reading about research methodologies. However, Blaxter et al. (2006) proposed that researchers need to develop a general awareness of research methods before reading around the subject matter and in the area of methodology. This is because this activity helps new researchers to have a clearer understanding of possible ways to carry out their research. Furthermore, this step will not only involve thinking, but also serious reading, to understand the philosophical issues and methods underpinning a research project. As different kinds of research approaches produce different kinds of knowledge (Blaxter *et al.*, 2006), an awareness of these issues is important to take at an early stage in the research.

The third step in the Blaxter et al.'s (2006) research process is 'reading for research'. This stage involves activities related to developing a literature review, such as reading strategies and library skills. The reading should not only focus on the subject matter, but also on the research approaches and techniques. Reading strategies include making decisions on what and where to read, critical reading and recording references.

'Managing your project' is the next step in the Blaxter et al.'s (2006) research processes. This stage involves managing the research project so as to complete it in time, and with the resources available. Activities include planning or scheduling the research, managing the supervisor, developing relationship with fellow researchers and colleagues, improving computer skills and preparing oneself for dealing with difficulties.

The next step in the Blaxter et al.'s (2006) research process is that of data collection. Issues to consider at this stage include access, ethics, sampling and selection as well as data collection techniques. The issue of access and ethics should be given some thought early on as it influences the kind of data one is able to collect. All research students at the case university must gain ethical approval (if required) for their projects early in the first year of their study. Furthermore, as a responsible researcher one should be aware of ethical issues around

privacy, informed consent, anonymity and confidentiality in handling the data collection, analysis and dissemination processes (Mauthner *et al.*, 2002). Sampling strategies should be considered at this stage, regardless of the research approach one is taking. This is because one will not be able to include everybody of interest in their research. Once the sampling strategies are determined, a researcher needs to consider techniques for data collection. Various techniques can be used, including documentary analysis, interviews, observations, questionnaires, clinical trials and experiments.

After data collection, the analysis phase is next. However, as discussed in Blaxter et al.'s (2006) book, the analysis of data could begin as soon as one has data to work on. It is argued that researchers should read through before deciding on the approaches and techniques of data analysis. This is to ensure that the researchers have an understanding of the best possible analysis to apply to different types of data.

The writing up stage is the final step in the Blaxter et al.'s (2006) research process. In this stage, several issues related to writing up need to be considered, such as drafting and re-drafting, organisation and structure, critical and academic writing.

3.1.3 *Wisker's model of research processes*

The third model comes from Wisker (2001)'s "The Postgraduate Research Handbook". Wisker's model follows the four main phases of a research student's work: (1) starting research; (2) getting going – supervisors, methods and time; (3) more detailed research methods and (4) support, progress, analysis, writing up, the viva, presentation and afterwards. Compared to Blaxter et al.'s, Wisker's model is more compact, as she grouped several activities into one stage whilst Blaxter et al.'s model spread out the activities into seven stages. Furthermore, unlike Blaxter et al., Wisker's model is not assumed as cyclical; however, some of the activities can be undertaken in parallel. The following sections discuss the stages in Wisker's model of the research process.

Phase 1: Starting Research

The starting research stage consists of four major activities: (1) starting postgraduate research; (2) choosing the right research degree; (3) choosing the supervisor(s) and (4) writing research proposals. In the first activity, Wiskers challenged student researchers to think about the

reasons for undertaking a research study, as the reasons strongly determine whether one has determination, enthusiasm and motivation to carry out the research study. Next, planning for research is considered to be an essential activity in a good research project. Furthermore, at this stage, it is deemed necessary to think about the research area, suitable topic and research questions that will likely to contribute to knowledge. It is also important to think about the expected research outcomes. Consistent with Blaxter et al., Wisker also recommended that students undertake an audit of research skills to recognise the skills currently possess and determine the skills needed.

Unlike Blaxter et al., Wisker included an activity that involves deciding on the research degree and institution. Various types of research degrees can be chosen, including Master of Arts (MA), Master of Philosophy (MPhil) and Doctor of Philosophy (PhD). A more detailed discussion about the research degree has been provided in the literature review chapter, and hence will not be repeated here. In general, once a decision about furthering a research degree has been made, the next logical step is to choose an institution. However, some students prefer to select the supervisor for their research specialism before selecting the university. Wisker recommended that students consider several factors when choosing a university, such as accessibility, facilities, reputation for completion, supervision and quality of research as well as intuition and feelings. For overseas students, further factors need to be considered, such as facilities for overseas students, accommodation, international office and reputation in terms of support for overseas students. For research students, factors such as accommodation, research structure such as training, seminars, and space for students, computer facilities and library support are usually important.

Students can either take a passive or active part in choosing their supervisors. In the passive case, the department or the university normally matches students with supervisors, based on the university's knowledge of their research specialisms. In the latter case, Wisker recommended that students look for research and publication interests of the academic staff to identify specialisms and their experience in dominant methodology. Once supervisors have been allocated, a research student is required to draw up a formal or informal learning contract with them. A learning contract is a document that sets out mutual expectations in terms of work, communication and responsibility between a student and supervisors.

The last activity in this stage is that of writing research proposals. Generally, students write

two research proposals. The first is to gain entry to a research degree programme, whilst the second is for first year progression. The first research proposal usually contains a statement of research interests, key research questions, a literature review, a proposed research methodology and research planning.

This section discusses the requirements and works to be done in the second research proposal. Depending on a university's regulations, a formal evaluation of the research proposal will be carried out to confirm second year registration. Students need to perform a substantial amount of work including developing a literature review and theoretical framework and determining the methodology and methods before the proposal is formally submitted for evaluation. Wisker proposed several areas that students need to address in a research proposal, such as indicative title, aim and focus of study, context of the research, theoretical perspectives and interpretations, research methodology and methods, research design, ethical considerations, outline plan of study, justification and primary references.

Phase 2: Getting Going – supervisors, methods and time

There are eight activities involve in this stage, including managing supervisors' and time, recognising learning approaches and styles, developing a supportive research culture, developing research questions and methods, carrying out a literature review and choosing appropriate research methodologies and methods.

Unlike Phillips and Pugh (2005) and Blaxter et al. (2006), Wisker (2001) included activities related to managing supervisors in the getting going stage. She argued that the key point in managing a supervisor is to have a mutual understanding about the expectation of each other in terms of supervisory meetings, rights and responsibilities. The Code of Practice for research students and supervisors documented this supervision arrangement (The Quality Assurance Agency for Higher Education, 2004). Furthermore, maintaining good working relationships is important to ensure the supervisor's full support throughout the research process. In the case of supervision at a distance, Wisker recommended setting-up e-mail contacts, video links or occasional visits. In addition to managing the supervisor, Wisker also included planning and time management activities. She recommended that research students make a long, medium- and short-term planning.

Other activity recommended in this stage was identifying learning approaches and styles of a

research student. In addition to determining current learning approaches and styles of a student, this activity also helps one adapting to appropriate approaches and learning styles in order to tackle certain kinds of research activities. Three learning approaches were identified in the literature: surface, deep and achieving or strategic learning (Marton and Saljo, 1976; Ramsden, 1979; Entwistle and Ramsden, 1983; Biggs, 1987). The surface learner tends to regard knowledge as the acquisition of a number of facts. Memorising becomes the main method of learning and no associations are made to fit new information into already developed learning. The deep learner looks for meaning associated with specific task, relates any new information to already established concepts and moves this on as new ideas emerge. In addition, the deep learner will proactively look for further resources, and will look at much more detail. The strategic learner only focuses on the end product, which is the result - the aim being to pass. This means that these kinds of student only learn what seems necessary, without linking information (Blaxter *et al.*, 2006).

Other activities recommended in this stage include setting up supportive peer groups locally and at a distance. The group could be set up among research colleagues or among students supervised by the same supervisor. Other recommended peer-support systems include research seminar series, postgraduate facilities and social activities and libraries and equipment.

The next activity involves considering the types and paradigms of research as well as ethical concerns in the research. In order to define the research types, a research student should be clear about the research questions and assumptions that he or she is researching. By having a clear understanding of the types of research, this may help to decide on the appropriate strategies and methodologies for the research.

Wisker also detailed the activities involved in carrying out a literature review at this stage. She discussed the purpose, as well as how to conduct the literature review. Moreover, the process of taking notes, storage and retrieval of literature were also explained in detail.

Other research activities at this stage involved choosing appropriate research methodologies and methods. The distinction between qualitative and quantitative research needs to be clearly understood, as this will inform the appropriate methods for data collection.

Phase 3: More Detailed Research Methods – maintaining momentum

The third stage of Wisker's research model mainly involved a discussion of research methods, such as designing questionnaires, action research and phenomenography, interviews, focus groups and observation, grounded theory, case studies, journal, research methods for the Arts and Humanities, as well as problem-based research.

Phase 4: Support, Progress, Analysis, Writing Up, the Viva, Presentations and Afterwards

Phase four of Wisker's research model looked at various issues involved in the final stage of the research study. These include the writing up activities. Wisker argued that it is considered to be an ongoing activity, rather than something that starts at the end of the year. However, at this stage, the focus is on the whole thesis and ensuring that everything fits into an overall cohesive work. Suggestions and comments on producing a good quality thesis appropriate for different research study levels were also provided at this stage.

Apart from the writing up activities, Wisker's model also included writing transfer documents and a progress report. However, she stated that it was common for the progress report to be written after one year of study or more regularly (yearly). A common practice in UK universities is for students to register for an MPhil with the aim of transferring to a PhD, which requires a transfer document to be completed and approved. It was argued that the progress report and transfer document could help to refocus the research by reflecting on progress so far.

Unlike Blaxter et al. (2006), Wisker included preparation for and undertaking the viva in phase 4. This may be because the book was written specifically for students undertaking research as part of an MA, MPhil, EdD or PhD degrees.

Wisker included presentations, conferences and publications as part of the stage four activities. She argued that by presenting, it could help a student to clarify, control and evaluate his/her research. Furthermore, useful feedback that can help develop the research further may be obtained by giving work-in-progress presentations.

Wisker finished stage four of her research model by including notes on life after the research. She recommended that students take a break and celebrate once they have finished with their

research degree. After the break, she suggested that students continue with some publications and presentations from elements of the thesis. Table 12 summarises Wisker's research process model.

Stages	Activities
Starting research	1. Starting postgraduate research 2. Choosing the right research degree 3. Choosing the supervisors 4. Writing research proposals
Getting going	1. Managing supervisors and time 2. Recognising learning approach and styles 3. Developing a supportive research culture 4. Developing research questions and methods 5. Literature review 6. Choosing research methodologies and methods
More detailed research methods	1. Research methodologies in detail 2. Research methods in detail
Support, progress, analysis, writing up, the viva, presentation and afterwards	1. Writing up 2. Preparing for the viva 3. Preparing for publications (conferences and journals) 4. Life after research

Table 12 – Wisker (2001) research process model

3.1.4 *Proposed model of research processes*

Based on the discussion of the three models, it may be seen that the models illustrate: (1) the process of undertaking a PhD; (2) the variation in the stages of study; and (3) the tasks or activities associated within each stage. Based on this literature review, the following stages of research and its associated information needs for this study are proposed. In this model, a student is expected to undergo six stages in their study: Application; Induction; Getting on; Developing, Completing and the Alumni stage. Since the aim of this research is to support all research students, prospective and alumni stages are also included. Each of these stages is discussed below.

Applicants

This stage is similar to Phillip and Pugh's (2005) *field of interest*, Wisker's (2001) and Blaxter et al.'s (2006) *getting started* stage. In this stage, a student will gather all information about an available program of study and the specific area of interest from various universities.

It is particularly crucial that the topic of the proposed research has a good fit with the research interests of the department being applied (Guy Fitzgerald, 2005). The reason is to ensure that there are available professors that will be able to supervise the student. A usual task is that the student will produce a preliminary proposal. Most universities in the UK require applicants for a research degree to write a proposal stating their area of interest and key research questions, as well as presenting a literature review, proposed methodology and a research plan.

Induction

After being accepted and registered at a particular university, research students will have an induction programmes that will be carried out either by the offering department, the faculty or both. At the induction stage, research students will be introduced to the university's general as well as academic information, such as the support systems and the research training programmes available. The students will also be given a research student handbook for their reference. Furthermore, documents relating to research degree regulations such as the code of practice handbook will also be given during the induction.

Getting on

Following the recommendations of the Roberts' Set for Success Review (2002), most departments now offer a research training programme to their students. At some universities, the training programmes sometime runs throughout the three years period of study. After going through the induction process, a student may undertake the necessary training programme modules that have been agreed with the supervisors. Furthermore, as recommended by Blaxter et al. and Wisker, a self appraisal or skills audit may be taken during this stage. It is recommended that this skills audit be undertaken every year, to assess the resources and training needs that could help students improve their skills and knowledge level.

While attending the research training programmes, students begin to develop their proposal. This is because the proposal originally submitted when applying is often quite different from the research that is eventually undertaken (Grix, 2001). In addition, the proposal at the application stage may serve as an indicator of the student's quality of writing, or as a base for the university to identify suitable supervisors. After a specific research topic is agreed with the supervisor, the student will start their research by undertaking a literature search on the

areas of their interest (Guy Fitzgerald, 2005). A literature review is essential to: (a) identify a gap in the literature; (b) focus and clarify the research problem; (c) highlight key debates; (d) define and identify terms and concepts in the topic area; and (d) contextualise the project within an existing knowledge base (Grix, 2001). A literature review cannot be viewed as "a compartmentalised stage of research" (Grix, 2001, p. 54). It should be viewed as a continuous process. A literature review that started in the first year of study should be constantly updated until the day the thesis is submitted. Furthermore, a literature review should be critical and analytical, not descriptive. In addition, it should demonstrate scholarship and a detailed awareness of the subject. It should identify key debates, different schools of thought, define terms and rigorous. It should also identify the gap(s) that the proposed research will address.

Wright and Lodwick (1989) reported that in addition to the literature review, students also undertake other tasks in their first year of study such as formulation of a research plan, preliminary field study (conduct experiment for science based students and survey for social sciences or humanities students), analyse the data collected and write up the results. However, they found that most science-based students were more likely to omit the literature review in their first year.

Developing

This stage can be considered as the second year of PhD research. The activities carried out during this stage mirror Blaxter et al.'s '*thinking about methods'* stage and Wisker's '*more detailed research methods'* phase. At this stage, research students will develop their research methods whilst attending training programme modules. As suggested by Blaxter at al. and Wisker, research students should develop an understanding of the philosophical issues and methods underpinning their research as early in their research as possible. This is important, as different research approaches produce different kinds of knowledge. Data collection and analysis are also expected to be carried out during this stage.

Completing

This stage can be considered as the third year of a PhD research degree. The tasks include re-visiting the literature, analysing findings, formulating conclusions, and writing up the thesis (Barnard and Rensleigh, 2008; Merkel, 2010). They also prepare themselves to present their works at conferences and publish their work in refereed journals.

Alumni

When finishing their study, students become alumni. It is important that the university keeps in contact with their alumni. This is because alumni are potential contributors (Belfield and Beney, 2000; Ho and Huang, 2009; Merkel, 2010) to their alma mater, and mentors (Jouannelle *et al.*, 2011) to the current students and ambassadors (Ireland *et al.*, 2012). According to the annual Rose-CASE survey, the number of alumni donors in the UK increased more than 10% in three successive years (Merkel, 2010). As alumni who have first hand experience and knowledge related to work in their field, they can guide current students to make appropriate career choices (Jouannelle *et al.*, 2011). Alumni, as student ambassadors, can help to promote their institutions by delivering messages to prospective students (Ireland *et al.*, 2012).

The tasks associated during each of the research process stages, as discussed above, are depicted in table 13.

Stages	Sequence of PhD Research Stages	Tasks
Stage 1	Applicant	Develop preliminary proposal Apply a place at universities
Stage 2 (Year 1)	Induction	Attend induction programme Familiarise with the research study lifestyle
	Getting on	Attend research training program modules Identify a research topic Develop a research proposal Conduct literature review Prepare a research plan Prepare for progression assessment
Stage 3 (Year 2)	Developing	Develop appropriate methodology Conduct pilot study Conduct actual data collection: field study/experiment Analyse the findings
Stage 4 (Year 3)	Completing	Attend conferences Publish papers in refereed journal Writing up the thesis Preparing for the viva
Stage 5	Alumni	Keeping contact with the university

Table 13 – Proposed stages of research and its associated tasks

The model proposed above is not intended to be prescriptive, since some students may have fallen behind due to many factors. However, it may be used to frame student's research. In addition, some of the tasks proposed may not be appropriate for some disciplines. However, the tasks may be modified to suit. The proposed model of research stages was used to develop the prototype research portal, which is then verified through four action research cycles.

3.2 Adult Learning Theories

In the introductory chapter of this thesis, the group of learners that forms the basis of this study were identified as research students, who were either studying a masters or doctoral level degree. This section reviews what adult learning is, in the belief that adult learning theories should form the basis for the design of an information infrastructure for the research degree environment.

3.2.1 *Andragogy*

When discussing adult learning theory, it is essential to consider Malcolm Knowles's (1980) theory of andragogy as it is one of the most well known theories to explain adult learning. Andragogy is a learning theory that is based on the premise that adults have different learning characteristics compared to children (Knowles, 1990). The six assumptions underlying andragogy are as follows:

(1) Adult learners need to know why they need to learn something before learning it;
(2) Adult learners have an independent self-concept and are able to direct their own learning;
(3) Adult learners accumulate a growing reservoir of experience, which is a rich resource for learning;
(4) Adult learners may have learning needs that are closely related to development tasks in their social roles;
(5) Adult learning may be problem-centred and interested in immediate application of knowledge; and
(6) Adult learners may be motivated to learn by internal factors such as self-esteem, quality of life and increased job satisfaction as opposed to external factors.

Assumption 1: Learners' Need to Know

The first assumption states that adults need to know why they should learn something. Knowles (1990) believes that without knowing the reasons and benefits of learning something, adults will struggle to find value in the learning process. Hence, Knowles (1990) argues that one of the most important tasks for an instructor is to help learners understand how what they will learn will be of use to them in the future.

Assumption 2: Learners' Independent Self-concept

Knowles (1980, p. 43) emphasises that "adults have a deep psychological need to be generally

self-directing, although they may be dependent in particular temporary situations". Despite their need to be autonomous, Knowles (1990) acknowledges that previous schooling has constructed adults as dependent learners. Therefore, he contends that instructors have the responsibility to encourage and nurture adults to become more self-directed. In this case, technology can play an important role in facilitating self-direction. For instance, personalisation features within the web portal enable adult learners to choose the most appropriate resources to reflect their needs (McLoughlin and Lee, 2008). The web portal facilitates self-direction, by providing options and choices (through the personalisation and customisation features) to adult learners whilst still providing the necessary structure.

A common misconception about this assumption is that "it is frequently assumed that student centeredness and the goal of achieving self-directedness in students, means leaving students to it" (Milligan, 1997, p. 488). A close reading of Knowles' (1980) assumptions on adult learners' self-concept reveals that he understand the fact that adults need to be self-directed, and as they mature, they became more able to take responsibility for their own actions. In fact, he did not indicate that being self-directed meant being left alone without guidance. Higgs (1993) argued that learners need to learn how to learn independently, and this requires guidance from an instructor skilled in such matters.

Assumption 3: Learners' Reservoir of Experience

Knowles (1980) argues that adults have accumulated a lifetime of different types of experiences. Knowles (1980) further asserts that adults, by having these experiences, want to use them and to be acknowledged for having this know-how. Brookfield (1986) supports Knowles' assertion that as people grow, they build up experience which can be used as a resource for learning. In fact, he believes that the value of critical reflection is one of the most important elements in adult learning (Stephen Brookfield, 1986). Mezirow's (1991) transformative learning theory also aligns with Knowles' assumption of valuing adult experience. He (1991, p. 6) argues that "reflective learning becomes transformative whenever assumptions or premises are found to be distorting, inauthentic or otherwise invalid". Mezirow's (1997) transformative learning theory is discussed in detail in the next section. This assumption can be translated into one design principle for the web portal. In order to provide an environment that encourages reflection, the web portal could be integrated with Web 2.0 tools that support reflective process such as blogs and e-portfolio.

Assumption 4: Learners' Readiness to Learn

The fourth assumption of andragogy believes that adults are ready to learn something when they identify the need to know it, in order to deal with a specific aspect within their lives (Knowles, 1990). For instance, to be effective, one may need to learn another language if travelling to a location where English is not the preferred language. Knowles (1998) also believes that adults are not only goal oriented, but also relevancy oriented. Therefore, they want to see a program that is organised towards their personal goals, and they want to learn something that is applicable to their work and home lives.

Assumption 5: Learners' Orientation to Learning

In terms of orientation towards learning, Knowles argue that adults "tend to have a perspective of immediacy of application towards most of their learning" (1980, p. 53). Since adults engage in learning after experiencing a need to learn something specific, they are more likely to be oriented to the problem or the performance (Knowles, 1990). For example, postgraduate students may become motivated to learn how to use reference management software when they know that the software would be an essential tool in organising their literature. Hence, by providing content relevant to postgraduate research activities or tasks through the web portal such as 'EndNote reference management software' and 'how to write a research proposal', Knowles' assumption 4 and 5 could be realised.

Assumption 6: Learners' Motivation to Learn

Knowles (1990) believes that adult learners may respond to external motivators such as better job promotion prospects or higher salaries, but they are best motivated to learn primarily by internal factors such as increased self-esteem and quality of life.

Steps to Realise Andragogy

Beside the sixth assumptions, Knowles' (1995) andragogical model includes the process design steps for implementing and capitalising upon the assumptions of andragogy. These steps include (i) preparing learners for the program; (ii) establishing a climate conducive to learning; (iii) involving learners in mutual planning; (iv) supporting learners in diagnosing their learning needs; (v) assisting learners in forming their learning objectives; (vi) engaging learners in designing their learning plans; (vii) helping learners carry out their learning plans and (viii) evaluating their learning outcomes. Table 14 shows the process design steps and approaches as presented by Knowles.

Process Design Steps	
Steps	**Andragogical Approach**
Preparing learners	Provide information Prepare for participation Help develop realistic expectations Begin thinking about content
Climate	Relaxed, trusting Mutually respectful Informal, warm Collaborative, supportive
Planning	Mutually by learners and facilitator
Diagnosis of needs	By mutual assessment
Setting of Objectives	By mutual negotiation
Designing learning plans	Learning contracts Learning projects Sequenced by readiness
Learning activities	Inquiry projects Independent study Experiential techniques
Evaluation	By learner collected evidence validated by peers, facilitators and experts. Criterion references

Table 14 – Process design steps of Andragogy (Knowles, 1980; Knowles, 1995)

Debates and Criticisms of Andragogy

Despite the popularity of andragogy, some authors have criticised its assumptions. A frequent debate is whether andragogy should really be considered to be a theory of adult learning. In their chronicle of debate, Davenport and Davenport (1985, p. 157) stated that andragogy has been classified as "a theory of adult education, theory of adult learning, theory of technology of adult learning, method of adult education, technique of adult education and a set of assumptions". Aware of this debate, Knowles later concurred that "andragogy is a model of assumptions about learning and a conceptual framework that serves as a basis for an emergent theory" (1989, p. 112). This research supports Knowles's view because it uses the model as a basis for designing an e-learning portal for adult research students.

A major criticism of andragogy is that it has not been empirically tested (Burge, 1988; S. D. Brookfield, 1995). Knowles (1989) counters this criticism by arguing that there has been significant research conducted on andragogy both qualitatively and quantitatively. He also argues that the critics' definition of the term 'empirical' is too narrow. His critics view

empirical research as being highly controlled, whereas Knowles considers that empirical research is not only limited to highly control environment (such as laboratories), but also includes qualitative approaches.

Regardless of criticisms of Knowles' conceptualisation of andragogy, many have acknowledged its influence in adult learning. Furthermore, it has also generated issues that are central to the concerns of the adult learners (Stephen Brookfield, 1986; Davenport, 1993; Milligan, 1997). In fact, Lee (1998) argued that the principles of andragogy are frequently employed in the teaching of adults. However, since assumptions of andragogy have become so embedded in the educational system, many fail to recognise them, and simply identify such methods as being good teaching practice.

3.2.2 *Transformative Learning Theory*

This section presents a brief overview of Jack Mezirow's (1991) transformative learning theory. The intention is to provide a synthesis of its major principles, rather than an exhaustive discussion that could be drawn upon to form the basis for the design of the information infrastructure in this study. This includes an introduction to the theory and a discussion of the main premises of the theory.

Transformative learning theory is defined as "a theory of adult learning which attempts to describe and analyse how adults learn to make meaning of their experiences" (Mezirow, 1991, p. 198). According to Mezirow, transformative learning is the process of making meaning from our experiences through reflection, critical reflection and critical self-reflection. The goal of this theory is to allow an adult learner to "become a more autonomous thinker by learning to negotiate his or her own values, meanings, and purpose rather than uncritically act on those of others" (Mezirow, 1997, p. 11).

Transformative learning occurs when people change their frames of reference by critically reflecting on their assumptions and beliefs and consciously reformulate key assumptions to bring about new worldviews (Mezirow, 1997). Mezirow (1991) believes that the catalysts for transformative learning are either the results of "disorienting dilemmas" which are prompted by life challenges, such as a bereavement, illness or a series of cumulative transformed meaning schemes or renewed frames of reference (Edward W. Taylor, 2008).

The main concepts in transformative learning theory are critical reflection, centrality of experience and rational discourse (Mezirow, 1991; Edward W. Taylor, 1998). It is argued that experience is the starting point for transformative learning, as people's assumptions are generally constructed by their interpretation of experience. Critical reflection provides the means by which current assumptions and beliefs are explored through the assessment of validity, in the light of new experiences or knowledge (Cranton, 2002). During the process of transformative learning, learners are involved in rational discourse. This discourse refers to

> "the type of dialogue in which we participate with others whom we believe to be informed, objective and rational to assess reasons that justify problematic beliefs, and which leads to a best tentative judgment that is subject to new insights, perspectives, evidence or arguments" (Adams, 2010, p. 56).

Mezirow (1997) argues that rational reflective discourse can be stimulated through various techniques such as discussions, critical incidents, structured group activities, controversial readings and provocative declaratives. In the web portal environment, providing tools such as discussion forums could encourage the practise of rational discourse.

This theory is considered by some as the constructivist theory of adult learning. Constructivism is a view of learning based on the idea that learners construct knowledge through experience. Woolfolk (1993, p. 485) describes the constructivist view of the learning process as follows:

> ……. "The key idea is that students actively construct their own knowledge: the mind of the student mediates input from the outside world to determine what the student will learn. Learning is active mental work, not passive reception of teaching".

According to Piaget (Appleton, 1993), the father of cognitive constructivism, learning does not occur by being passive recipients, but by being involved in the active construction of meaning. Similar to the process of transformative learning, constructivist learners revise their understanding of the world when a new experience is in conflict with their current way of thinking. They do this by assimilating this new experience into their existing knowledge. However, when they are unable to make sense of this new experience, they accommodate it into their existing knowledge by restructuring their present knowledge to a higher level of thinking (Appleton, 1993). Another form of constructivism is called social constructivism, initially proposed and developed by the Russian cognitive psychologist Vygotsky (1986).

Since social constructivists believe that knowledge is created through the process of social exchange, the collective generation of meaning amongst people is considered important (Jonassen, 1991). In other words, social constructivism believes that a learner obtains his or her knowledge through a process of negotiation, verification and interaction with other members in a community, and agrees on shared knowledge with members in a group, community or society (Prawat and Floden, 1994).

3.2.3 *Summary of adult learning theories*

Having discussed adult learning theories, this section summarises their main points. Knowles' andragogy proposes that adult learners need to know why they need to learn something; appreciate higher learner control; have a great deal of experience to bring to educational setting; ready to learn; problem-centred; and best motivated by internal factors. Similar to andragogy, transformative learning also values adult experience. Both theories believe that critical reflection of learners' experience is central to the process of learning. Since constructivism believes that each learner constructs meaning from experience, it is congruent with adult learning concepts of self-direction and transformative learning. Social constructivism believes that the process of knowledge construction occurs through social interaction with others.

3.3 Adult Learning Theories, Postgraduate Research and Web-based Applications

Having explored the principles of adult learning theories, the researcher contends that the adult learning theories approach to teaching and learning is congruent with research degrees. The statement made by Knowles that "you don't just throw them into the strange waters of self-directed learning and hope they can swim" (1980, p. 98) applies directly to the dissertation research. It is true that the process of becoming a self-directed learner is not easy, and certainly the production of an original thesis has resulted in anguish in students and supervisors alike. In research degrees, students together with their supervisors often set deadlines which must be followed by the students. However, supervisors cannot assume that students will be self-directed and successful without any support. Therefore, supervisors should act as facilitators in encouraging students to be autonomous, independent learners. In the web portal environment, in addition to supervisor's guidance, online support could be developed so as to facilitate the requirements of research students, as outlined in the principles of adult learning theories.

Research indicates that "with effective e-learning technologies we can create active, engaged, collaborative and inquiry-based learning opportunity" (Wishart and Guy, 2009, p. 142). Moreover, Harasim (1990) reported that some educators believe online environments to be appropriate in supporting collaborative learning, since they emphasise group interaction. Asynchronous communication tools such as e-mail, discussion forums and chat rooms have been shown to enhance learning in the blended learning environment and augmented classroom online discussions by supporting reflection, social negotiation and knowledge construction. For instance, Gilbert and Dabbagh (2005) used WebCT™'s discussion forum to facilitate asynchronous discussions. They examined the impact of 'structuredness' of asynchronous online discussion protocols and evaluation rubrics on meaningful discourse. The study analysed 12 online discussion transcripts across four semesters, and involved 87 participants from four different parts of a graduate course. The findings revealed that the facilitation and evaluation of online discussion guidelines increased the cognitive quality of student postings, thus promoting a deeper and more meaningful understanding of the course.

Various researches have made connections between students' e-portfolio and reflection (Paulson *et al.*, 1991; Ahn, 2004; Buzzetto-More, 2010). These studies have asserted that a student's e-portfolio can make significant contributions to learning reflection. Whilst Paulson et.al (1991, p. 5) argued that students' e-portfolios are "a laboratory where students construct meaning from their accumulated experience", Ahn (2004) believes that an e-portfolio is the most effective and efficient mechanism to encourage students to reflect on their own learning processes and for teachers and peers to give feedback. Buzzetto-More (2010) conducted a survey on groups of students who had completed an e-portfolio supporting a "Strategic Management" course. The findings revealed that about 91% of the respondents agreed or strongly agreed that the portfolio building process encouraged them to think about the professional knowledge, skills and abilities that they had acquired. This result indicates that by developing e-portfolios, learners engage in reflection which is critical in the constructivist learning approach. Murphy (2007) argued that such constructivist learning can also be observed in the dissertation research study as students progress from a halting start in identifying the research topic to fluent execution of the research.

Other tools that are purported to support reflective thinking in collaborative learning are social software (Ferdig, 2007). Examples of social software tools that have demonstrated an ability to support collaborative learning includes web logs, wikis, social networking and

social book-marking (Ellis and Cohen, 2009; Chong, 2010). Churchill (2009) explored the use of web logs among a class of postgraduate students over the period of one semester. He used a blog-based environment, in which students were instructed to access course material from the facilitator's blog, to post reflections on their own blog, to feature artefacts created through the learning tasks on their own blog and to comment on each other's' contributions. The findings from a survey and interviews of selected students conducted at the end of the semester suggest that students participating in the study agreed that blogging facilitated and contributed to their learning. Aspects of blogging that contributed to students' learning were accessing and reading the blogs of others, receiving comments and previewing tasks completed by other students. The interview data showed that participating students believed that they learned new things by viewing the work of others. This finding supported the claim that social software tools, in this case a web blog, supported collaborative learning and reflective thinking.

In addition to supporting reflection and collaborative learning, a web blog also has been used to enhance the initiation of undergraduate students into academic research. For instance, a recent study examined the use of blogging to facilitate students' research projects (Chong, 2010). The study used a blended class setting that integrated blogging with face-to-face lectures and tutorial sessions. The students' blog postings, together with their respective string of blog comments, term papers and survey feedback, were compiled and analysed. The findings revealed that blogging served as a useful platform for fostering students' research skills.

This section has reviewed several studies that have linked the adult learning theories with various web-based tools. This review did not intend to limit the web-based applications as found in the literature, but its purpose was to illustrate some empirical research that successfully used the tools in facilitating or supporting the principles of adult learning. Despite the fact that the studies reviewed was not particularly focused on the issues of research students, the work indirectly provided arguments for the use of these web-based tools to support the learning approach as outlined in the adult learning theories. Table 15 maps the principles in adult learning theories with the web-based tools that supported them.

Principles in Adult Learning	E-learning tools that supported the process
Reflection	e-Porfolio (Buzzetto-More, 2010), web blogs (Chong, 2010)
Collaboration	Web blogs (Chong, 2010); discussion forum (Gilbert and Dabbagh, 2005), email
Self-directed learning	e-Portfolio; web blogs, wikis; RSS

Table 15 – Mapping of principles of adult learning to E-Learning tools

3.4 The Adult Learning Theories as a basis for designing the Generic Web Portal

The previous section has mapped the principles of adult learning theories with the nature of postgraduate research and web-based applications. This section attempts to synthesis the adult learning theories and proposes that they provide a basis for designing the generic web portal.

The principles of andragogy suggests that adult learners are self-directed, have experience and competence and a readiness to learn. These principles suggest that personalisation and customisation capabilities could be built into the generic web portal that could provide more individualised supports to its users particularly research students.

According to Knowles (1980) adults' readiness to learn is proportional to their need to know. If their need to know is high, their readiness to learn will possibly be high. In addition, their orientation toward learning is more problem-centred or task-centred. Basing on these principles, design for the web portal could be proposed. In order to provide the condition that could support these principles, relevant content could be identified and integrated within the web portal.

The studies on the area of web 2.0 applications discussed in section 3.3 provide evidences of how web-based tools could be employed to support the reflective and collaborative learning. In addition, Gilbert and Dabbagh (2005) have shown that tools such as e-mail, discussion forum could be used to support collaboration among students. These studies point to the next design criteria for the generic web portal. In order to provide a condition for reflective and collaborative learning, email, discussion forum and web 2.0 tools such as wikis, blog, and social media could be integrated within the web portal.

3.5 Theory of Stages in Socialisation Development

The socialisation of students into research and academic endeavour is an important aspect of the postgraduate research student's experience. In understanding the processes involved in the

postgraduate research students' socialisation, Weidman et al.'s (2001) socialisation theory is a helpful model. In essence, the theory provides the conceptual lens through which the design of the web portal could be based. Therefore, this section is dedicated to discussing Weidman's (2001) theory of graduate socialisation.

Socialisation is a process through which an individual learns about particular values, knowledge, skills, attitudes, beliefs and norms in order to become a member of a group, organisation or society (Dunn *et al.*, 1994). In the case of graduate students, Golde (1998, p. 56) describes the socialisation process as "one in which a newcomer is made a member of a community". The community referred to is the community of an academic department in a particular discipline. Golde (1998) argues that postgraduate students experience two socialisation processes simultaneously: (i) socialisation to the role of the graduate student; and (ii) socialisation to the academic life and the profession. Weidman et al. (2001, p. 5) added that graduate students' socialisation is "the process through which individual gains the knowledge, skills and values necessary for successful entry into a professional career requiring an advanced level of specialised knowledge and skills".

Weidman et al.'s (2001) theory of graduate student socialisation is based upon Thornton and Nardi's (1975) work on role acquisition. According to these authors, there are four overlapping and developmental stages of graduate student socialisation. First, in the anticipatory stage, which covers not only the beginning of postgraduate life but also the preparatory and recruitment phases, postgraduate students need to learn new roles, procedures and agendas to be followed. In addition, as they proceed, they "become aware of the behavioural, attitudinal and cognitive expectation held for a role incumbent" (Weidman et. al, p. 12). They also tend to seek information, listen carefully and obey instructions.

Second is the formal stage in which students receive formal instructions through induction programmes. In addition, during this stage postgraduate students observe the activities of role incumbents and older students and at the same time learn about normative role expectations and how they are carried out. In terms of graduate activities, students are generally concerned with task related issues such as mastering academic matters as well as negotiating the university environment. Communication at this stage is "informative through learning course material, regulative through embracing normative expectations and integrative through faculty and student interaction" (Weidman *et al.*, 2001, p. 13).

Third, the socialisation stage is called the informal stage, where students learn informal role expectations through interactions with current role incumbents such as older students. They also receive behavioural clues, observe acceptable behaviour and thereby respond and react accordingly. As students progress through the socialisation process, they begin a transformation which makes them feel less student-like and more professional.

Finally, students will progress to the personal stage. This stage is described as the stage when students' "individual and social roles, personalities and social structures become fused and the role is internalised" (Weidman *et al.*, 2001, p. 14). During this stage, postgraduate students are believed to accept the value orientation of particular disciplinary culture and modify their behaviour to meet the expectations of that specific disciplinary culture. Furthermore, they tend to focus more on professional matters such as the publication and presentation of research papers, as well as their career marketability.

In conclusion, the theory of stages in socialisation development could provide the basis for designing the web portal. In particular, the theory could contribute to the way that information resources within the web portal are structured. Base on this theory, graduate students go through different stages of socialisation development: anticipatory, formal, informal and personal stage. Therefore, the information resources within the portal could be structured to provide relevant and appropriate content that could support each stage of the graduate students' socialisation development. For example, during the anticipatory stage, as research students prepare to start their study, generally they need to learn a great deal about their new roles and environment. Thus, it would be appropriate to provide information resources through the web portal that is related to research students' roles and the university and its surrounding.

3.6 Requirements for a Postgraduate Research Study

As the focus of this study is on designing and developing the web portal that could support research students throughout their research life cycle, it is appropriate to delineate the requirements for research study. By recognising the requirements for postgraduate study, this thesis provides a basis for designing and developing the web portal. Therefore, this section is dedicated to a discussion of the relevant literature pertaining to the requirements of students pursuing a research degree. The literature sources include study guides, education policies and

research related to postgraduate research study.

On the subject of postgraduate research study, the attention of this section narrows down to the doctoral research study. However, the material discussed is to some extent relevant to other postgraduate research studies.

3.6.1 *The Nature of doctoral research*

Studying for a doctorate degree is significantly different from studying for an undergraduate degree. In undergraduate education, a well-structured curriculum is laid down for the students. The curriculum tends to cover well-established knowledge formed as a result of past research activities (Finn, 2005). During the course of undergraduate study, most students share similar experiences to their colleagues. Handouts are often provided, textbooks are specified and practical sessions are included (Estelle M. Phillips and Pugh, 2005). In addition, electronic resources such as lecture notes, assessment materials, announcement, and communication tools are often accessible through a VLE. Undergraduate students go through several stages of assessments, and they can often access past exam papers for references.

In contrast, curriculum is only available for the research training component of the traditional PhD (pure research), the Integrated PhD and some professional doctorates such as the Doctor of Business Administration (DBA) programmes. It may be said that the students design their own PhD curriculum in collaboration with their supervisors. Thus, the process of developing competent PhD graduates can be thought of as highly idiosyncratic for each student (Malhotra, 2006). In order to undertake original research, doctoral students need to acquire the generally accepted knowledge relating to a research discipline as well as mastering the development and understanding of certain and uncertain knowledge. The development and evaluation of this tentative knowledge becomes part of the major characteristic of doctoral research (Finn, 2005). Since this is the nature of the PhD it requires PhD students to have a high level of self-discipline and perseverance (Grix, 2001). The differences between undergraduate and postgraduate research study are summarised in table 16.

Undergraduate study	PhD research
Well-structured curriculum	Undefined curriculum
Study what is known	Study what is known and unknown
Your time is scheduled for you	More freedom for prioritising and deciding your own research and pattern of working High level of self-discipline
Collective experiences	Highly idiosyncratic experiences

Table 16 - Summary of the differences between undergraduate and postgraduate research study (Grix, 2001; Finn, 2005; Malhotra, 2006)

The differences between doctorate research and undergraduate or postgraduate taught courses imply the need for finding different ways of utilising web-based technologies in order to support research students. Furthermore, evidence from previous research on the use of web-based technologies to support research students in the context of specific modules showed mixed results (Lim *et al.*, 2008; Meyer, 2010; Rockinson-Szapkiw, 2011). Further analysis suggests that this may be due to the fact that module-based approaches were used, rather than considering an approach that was embedded across the whole research programme. Therefore, this research was dedicated to exploring how web-based technologies could be exploited to provide support throughout the research study's life cycle.

3.6.2 *Research skills training*

Traditionally, the UK PhD has been viewed as a master-apprentice model whereby doctoral students are expected to learn the necessary skills and competences from their supervisors (Hoddell *et al.*, 2002; Ulhøi, 2005). However, towards the late 1980s a number of difficulties have been identified. Not only the issues of "why it took some people so long to complete their doctorate" but also "whether the doctorate in its present form was needed" have been addressed (Becher *et al.*, 1994, p. 51). In addition, many researchers (Booth and Satchell, 1995; Golde, 1998; Bourke *et al.*, 2004; Park, 2005b; Stock *et al.*, 2006) report high rates of attrition among doctoral students. These factors have caused concerns for the research councils (who provided government funding for some doctoral researchers) and have led to the production of several reports, i.e., Winfield (1987), Dearing (1996), Harris (1996) and Roberts (2002).

In an effort to improve completion rates, the research councils generally introduced sanctions for polytechnics and universities who did not meet their requirements (Delamont, 1989). The policy was to withdraw financial support for doctoral studentships from departments or universities with completion rates that were deemed unsatisfactory (ESRC, 1987; Burgess *et*

al., 1995). In addition to the sanction policies implemented in 1985, the ESRC also responded by setting up an enquiry into the submission rates of social science PhDs (Winfield, 1987). One of the recommendations from the Winfield report was that the ESRC should provide support to only two types of scheme: doctoral programmes, with a high training component and doctoral programmes aimed primarily at the generation of new knowledge (Winfield, 1987). In response to the recommendations, the ESRC decided that its funds would only go to students who undertook generic training as part of their programme (ESRC, 1987).

It was the concern and debate relating to submission rates that contributed to funding issues among HE institutions in the UK (Delamont, 1989). Since the ESRC decision, a department wishing to receive ESRC-funded studentships had to comply with ESRC guidelines. These guidelines indicated that a department should provide training that occupies 60 percent of the student's time in the first year of registration (Silk, 1988; McKendrick, 1994). Since then, the training agenda of PhD research has become the concern of many (Pilbeam and Denyer, 2009). The Dearing report (1996), for example, recommended enhanced provision of skills training and research support. The Harris recommendations (1996) called for appropriately located research training within faculties where research-active staff are based. In 2001, the research councils and the Arts and Humanities Research Board (AHRB) identified a set of generic and transferable skills training which were considered to be an important part of the doctoral programme (Research Councils UK, 2001). This covered research skills and techniques, the research environment, personal effectiveness, communication skills, networking, team-working, and career management. However, the most influential report that led to significant changes in the training of doctoral students was the Sir Gareth Robert's report (2002). The report argued that HE institutions were not quick enough to adapt to the training needs and expectations of the industry and potential students, and thus recommended that "the training elements of a PhD – particularly training in transferable skills – need to be strengthened considerably" (Roberts, 2002, p. 132). The report suggested that the minimum standard for formal skills training should be at least two weeks (or equivalent) per year.

There have been various developments in the provision of the doctoral research training since the Roberts' review. The Code of Practice (CoP) relating to research degree programmes issued in 1999, for example, was revised in 2004 to incorporate many of the recommendations of the Joint Statement of the Skills Training Requirements for Research Students (Research Councils UK, 2001; The Quality Assurance Agency for Higher Education, 2004). In addition,

significant government funding through the research councils and the Office of Science and Innovation was allocated to HE institutions to develop research and transferable skills training, in line with the Roberts' review (UKGRAD, 2007a). Furthermore, the research councils also funded a programme called the Vitea (previously known as 'UK GRAD') Programme (UKGRAD, 2007b). The programme provided a range of activities to support HE institutions embed personal and professional development and career management skills into their research degree programme (Metcalfe, 2006). These activities included:

- GRAD courses – The UK GRAD run national, regional and local courses for postgraduate researchers;
- Events – The UK GRAD organises national and regional conferences, good practice workshops and policy fora;
- Publications – The UK GRAD researches and publishes reviews of topical issues in postgraduate research training, i.e., the use of Personal Development Plans for postgraduates and PhD graduate destinations;
- Online resources – The UK GRAD provides downloadable resources and advice for developing postgraduate research skills.

Another influential driver of change in the UK doctoral skills training was the Bologna process (Bologna Declaration, 1999). The Bologna process is a European reform process that aimed to establish a European higher education Area by 2010 and to promote the European system of higher education worldwide. The key elements in the strategy for achieving these objectives were:

- the adoption of a system of easily comparable degrees with two main cycles, i.e., Bachelors and Masters;
- establishing a system of transferable credits for degree programmes;
- promoting the mobility of students between member states by overcoming obstacles;
- promoting European cooperation in quality assurance; and
- promoting European dimensions in higher education (Park, 2007).

It was in the Berlin Communique (2003) that the 'third cycle', the training for doctoral students was integrated within the context of Bologna. It was stated that the ministers

> "emphasise the importance of research and research training and the promotion of interdisciplinary in maintaining and improving the quality of higher education and in enhancing the competitiveness of European higher education more generally" (Berlin

Communique, 2003, p. 7).

Based on the discussion above, it is clear that the training scheme for doctoral students is here to stay. However, UK universities are expected to fund the doctoral training themselves, since the Roberts' funding is only guaranteed until the 2010-11 academic year (Research Councils UK, 2010). Therefore, this study is keen to address this problem by exploring the possibilities of providing personalised training resources offered through a web-based portal. Furthermore, findings from previous research on the use of web-based technologies to support research students have indicated that an online training resource has been broadly welcomed and appreciated (Rossana Espinoza and Hammond, 2008; Joyes and Banks, 2008).

3.6.3 *Standards required for the PhD*

It has been argued in the literature that the standard expected of research students includes originality, contribution to knowledge, suitability for publication and independence (Grix, 2001). The first three features generally relate to the standard of a PhD thesis, whilst the independence attribute is associated with the person conducting the PhD research. The following sections discuss these standards in further detail.

Originality

The word 'originality' often appears in examiners' guidance notes prepared by universities as a basis for grading theses. One example includes the following excerpt from the Newcastle University's Handbook for Research Students and Research Supervisors (2006, p. 92). A thesis should "demonstrate an ability to conduct original investigations and to test the ideas of the candidate and those of others". However, Nightingale (1984) reported that some examiners demand more clarity of the assessment criterion than merely the statement that a PhD thesis should make a substantial and original contribution to knowledge.

The debate around the meaning of 'originality' has been central in the research literature. Social science academics interviewed by Phillips' (1993) study agreed that originality means 'creative' or 'significant'. Phillip and Pugh (2005) reviewed previous research on the meaning of originality, providing 15 alternative definitions:

- carrying out empirical work that has not been done before;
- making a synthesis that has not been made before;
- using already known material but with a new interpretation;

- trying out something in this country that has previously only been done in other countries;
- taking a particular technique and applying it in a new area;
- bringing new evidence to bear on an old issue;
- engaging in cross-disciplinary research and using different methodologies;
- looking at areas that people in the discipline have not looked at before;
- adding to knowledge in a way that has not been done before;
- setting down a major piece of new information in writing for the first time;
- continuing a previously original piece of work;
- carrying out original work designed by the supervisor;
- providing a single original technique, observation, or result in an otherwise unoriginal but competent piece of research;
- having many original ideas, methods and interpretations all performed by others under the direction of the postgraduate; and
- showing originality in testing somebody else's idea.

Although the list is not exhaustive, it gives an idea of what is meant by being original.

Contribution to knowledge

Coupled with the concept of originality, a PhD thesis is also expected to show a contribution to knowledge. Regarding this standard, Tinkler and Jackson (2000) found that all participating universities in their research had policies that require a PhD to contain an original contribution to knowledge or understanding. Grix (2001, p. 12) elaborated on what it meant to contribute to knowledge:

> "… The point of research should not be to give an analysis of a critique of an event, but to deliver an interpretation of the event itself. You need the tertiary material (texts on texts) and the secondary material (others' work on the event) to position and guide your work and to situate your contribution, but the aim is to complement this with primary or new material or with a novel interpretation".

In addition to the novel interpretation of the situation mentioned above, a contribution to knowledge also means: (i) "a contribution to the conceptual or theoretical development of a research discipline"; (ii) a demonstration of "the ability to carefully consider and select an appropriate research methodology"; and (iii) "evidence of critical evaluation in the literature review, research methodology, research findings and the wider research discipline" (Finn,

2005, p. 14-16).

Suitability for publication

Suitability for publication is always cited as one of the standards looked for by most universities and examiners. As Johnston (1997, p. 342) concluded in her analysis of examiners' reports on doctoral theses, "it appeared that one of the yardsticks used to assess a thesis was its standard with respect to publishable work". The finding from Phillips (1993), Winter et al. (2000), Tinkler and Jackson (2000) and Mullins and Kiley (2002) also support this view.

Mullins and Kiley (2002, p. 379) reported that "most examiners looked for sufficient quantity as well as quality of work…". In terms of the quality of PhD theses, examiners expected there to be sufficient material in the theses to allow articles to be published in well-respected academic journals. This does not mean that students are required to publish work during their candidature but some or all of the work should be of publishable quality. In general practice, however, a student is encouraged to publish during candidacy, to show that their thesis includes publishable material.

Independence

A higher degree of independence is expected when one undertakes PhD research than at undergraduate level. However, what does it means to be independent? In addressing this question, Finn (2005, p. 13) argued that

> "A PhD graduate is expected to be able to conduct advanced research without supervision, and be capable of identifying research questions of relevance and significance, designing an appropriate and feasible methodology to test such questions, and communicating the research findings at a level of significant scholarship".

However, the concept of independence in a PhD degree is known to be a hurdle to novice researchers. Hockey (1994) elaborated on this problem by stressing that the "structuredness" of taught courses that they had attended may not prepare them well for the independent nature of doctoral degrees. However, students who have experience of working in a research-related environment prior to doing a PhD might find it easier to adapt to the independent nature of PhD research than fresh graduates. If not managed properly, this issue could be a factor that may contribute to drop outs or unsuccessful completions.

In attempting to explain the factors that facilitate or impede the transition from novice researcher to independent scholars, Lovitts (2005) presented a theoretical model based upon six aspects, which are intelligence, knowledge, thinking styles, personality, motivation and environment. The first five aspects relate to the individual resources. The environment factor is divided into micro – location, advisor, department, peers and academics and macro environmental – culture of graduate education and discipline. The individual resources interact with and are influenced by factors in the micro and macro environments.

This section has discussed the requirements for research students. In doing so, it has highlighted specific issues that research students need to deal with such as the originality, contribution to the knowledge and publication. These issues strongly justify the difference in nature of study between undergraduate taught courses and postgraduate research programmes. Therefore, with these considerable distinctions, this thesis adopts the view that different approaches to providing online support for research students should be explored.

3.7 A Synthesis of Critical Literature Review Chapters

The preceding sections of the critical literature review on postgraduate research study revealed that the principles of adult learning theories map well onto the nature of research study and web-based application. Adult learning theories suggest that knowledge is created through social interactions, and that collaboration and reflection are common characteristics of adult learners. Further analysis of the doctoral research literature discovered several other requirements for postgraduate study, such as research skills training, independence and originality of research. Based upon the critical literature review chapters, the thesis proposes the following model for research students' support in a blended learning environment, as shown in figure 16.

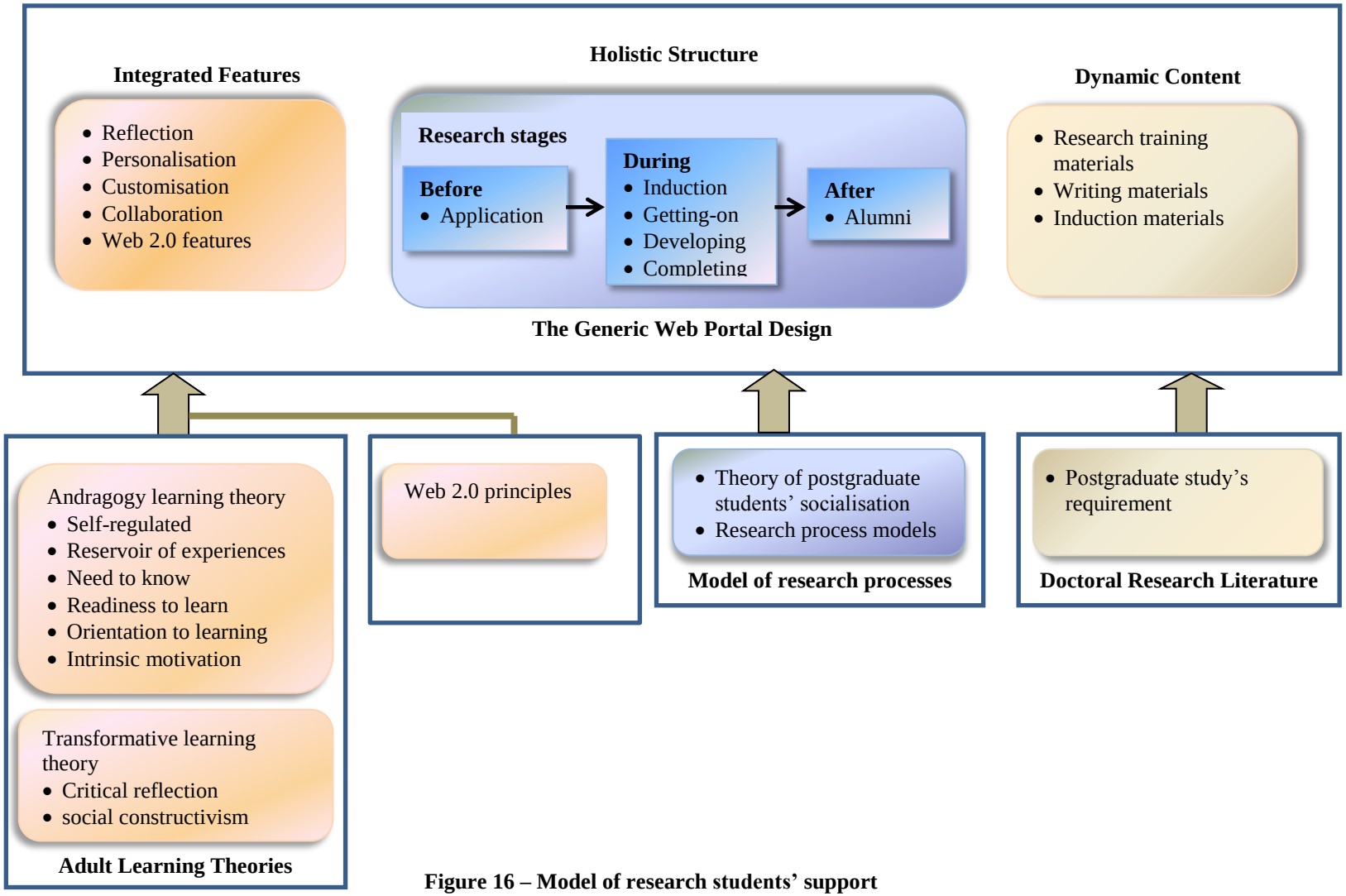


Figure 16 – Model of research students' support

3.8 Summary

This chapter has reviewed and discussed relevant literature relating to research degrees. Section 3.1 discussed and proposed a model of postgraduate research life cycle, section 3.2 focused on discussing relevant adult learning theories that could inform the design and development of the generic web portal. Continuing this thread, section 3.3 strengthened the thesis argument by investigating the relationship between adult learning theories, postgraduate research and web-based applications. This was achieved by mapping adult learning theory principles with the nature of postgraduate research and features offered by web-based tools. Following this, section 3.4 interpreted how the adult learning theories could inform the design and development of the generic web portal. Section 3.5 discussed the theory of stages in socialisation development of research students, in the belief that this theory could provide a conceptual lens through which the structure of the support for postgraduate students could be provided. Finally, section 3.6 detailed the requirements of postgraduate research study. These included research skills training and the required standards for a doctoral research degree.

The next chapter discusses the approach and methodology deployed to assist in the empirical investigation.

Chapter 4. Methodology: Philosophy and Approach

Chapter two presented the analysis on the current research status of the e-learning field. Continuing the thread of these discussions, chapter three examined the research degree literature that set the context in which this study is based. In this chapter, the issues of research methodology, method and data collection techniques adopted in this study are discussed.

Consequently, this chapter begins with an examination of the philosophical assumptions underpinning empirical research. In this section, the advantages and disadvantages of applying different approaches to study information systems (IS) are examined and discussed. The next section investigates various kinds of research strategy that have been deployed to study different aspects of e-learning. After reviewing these common research methods, the reasons for adopting an action research method as a strategy for this particular research are discussed. Following this, the details of data collection techniques and data analysis that were used in this research are provided. Finally, the chapter concludes with a research framework for the current study.

4.1 Philosophical Perspectives

The primary aim in choosing the research strategy is to decide on the best route to take in order to answer the established provisional research questions. Smith and Dainty (1991) argued that in order to achieve a successful outcome to the research, one has to understand the assumptions, values and paradigms underlying the approach chosen. The term ‘paradigm’ used in this thesis refers to the broad philosophical beliefs, which are based on “assumptions about knowledge and how to acquire it, and about the physical and social world” (Hirschheim and Klein, 1989, p. 1201). This section attempts to outline some of the main principles surrounding two distinct philosophical perspectives used to study Information Systems (IS) research and provides justifications for choosing the interpretive paradigm as the underlying philosophical perspective for this study.

In general, there has been a tendency to categorise IS research into one of two different approaches: quantitative or qualitative (Miles and Huberman, 1994). All research, be it quantitative or qualitative, is based on some assumptions about what constitutes valid research and appropriate methods. Quantitative research inclines towards positivism whilst more heterogeneous paradigms are associated with qualitative research. Guba and Lincoln

(1994) proposed four paradigms that qualitative research can subscribe to which are positivism, post-positivism, critical theory and constructivism. On the other hand, Orlikowski and Baroudi (1991) suggested that qualitative research can be categorised based on three underlying paradigms: positivist, interpretive and critical. However, the paradigms that have received widespread attention from IS researchers are positivism and interpretivism (W. J. Orlikowski and Baroudi, 1991; Allen S. Lee and Baskerville, 2003). Therefore, the paradigmatic discussion in this thesis will simply focus on positivism and interpretivism. For the purpose of clarity, the word 'interpretive' as used here is not as a synonym for qualitative, but as one of the paradigms that qualitative research can subscribe to.

Five Philosophical Assumptions

According to Cresswell (1998), there are five philosophical assumptions that determine a researcher's paradigm: ontology, epistemology, methodology, axiology and rhetoric. Ontology refers to the theory of reality. The fundamental ontological question is concerned with what reality is and what can be known about reality. On the other hand, epistemology addresses the theory of knowledge and the process of acquiring knowledge. The fundamental epistemology question is how valid knowledge is obtained. Axiology deals with the issue of the role of values used in the research, whilst rhetoric considers the style of language used in the research. Finally, methodology refers to the process of conducting empirical research (Cresswell, 1998).

The next section compares and contrasts the positivist and interpretive approaches on the basis of the five philosophical assumptions discussed above. In doing so, the advantages and disadvantages of the two approaches in the IS area will be examined. Finally, justifications for considering interpretive paradigm as appropriate for this research will be presented.

4.1.1 *Positivist paradigm*

The positivist approach to study the nature of technology and its consequent impacts in IS research has long been employed. In their review of the trends in information system research methods, Chen and Hirschheim (2004) found that positivist research dominated 81% of the published empirical research in major IS publication outlets between 1991 and 2001. This approach has been explicitly recognised, and advocated, as the natural science model of social science research. According to the positivist school of thought, it is only by applying natural science methods that social sciences will be able to explain, predict and ultimately control

social phenomena.

According to Orlikowski and Baroudi (1991, p. 5), IS research can be classified as positivist if there is evidence of "formal propositions, quantifiable measures of variables, hypotheses testing, and the drawing of inferences about a phenomenon from the sample of a stated population". From this classification, five philosophical assumptions that are rooted in positivist research can be revealed. At the ontological level, a researcher is assumed to be objective and detached from the objects of research. Based on this perspective, reality consists of only facts that are structured in a law-like manner (Evered and Louis, 1991). Consequently, positivist researchers perceive knowledge as context free and controlled through cause and effect laws (Guba and Lincoln, 1994). Epistemologically, positivists believe that knowledge should be obtained through "hypothetic-deductive testability of theories" (Chen and Hirschheim, 2004, p. 14). In this view, researchers start deductively with a theory and attempt to test it. Methodologically, positivists contend that to test hypothetic-deductive theory, researchers depend on reductionism, repeatability and refutation of the main techniques of the positivist paradigms (Oates, 2006). Since positivist researchers are objective, no values are given except to the pre-defined variables and individual biases are carefully controlled by research steps. As for the language of research, positivists traditionally adopt formal writing style using impersonal passive voice and technical terminology to report their findings (Tashakkori and Teddlie, 1998).

Although the positivist approach to research is longstanding and widely recognised, there have been debates about its limitations. Galliers and Land (1987) viewed information systems as not only a technical system, but also concerned with the environment, whereby interactions between technology and humans take place. In other words, there are contextual elements embedded in this environment that should be taken into consideration. In line with this, Kim (2003) argued that these influential contextual factors might be easily ignored by the positivist approach when there is a tendency to examine only phenomena that are readily observable.

Another inherent constraint of the positivist method is measuring phenomenon that are subjective, by their very nature (Kim, 2003). For example, a positivist researcher could make a measurement error when "different measurement procedures stemming from different operational definitions potentially lead to different conclusions about the same construct" (Kim, 2003, p. 12). However, in different areas, positivist measurements can provide

researchers with an efficient means of grouping and quantifying complex human behaviour (Kim, 2003).

4.1.2 *Interpretive paradigm*

In contrast to a positivist perspective on social science research, proponents of the interpretive approach consider that the world is socially constructed through the interpretation of people within it. In their classification of interpretive IS research, Klein and Myers (1999, p. 69) stated that,

> "[Interpretive IS research] assumed that our knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools and other artefacts".

On the basis of five philosophical assumptions, there are contrasting worldviews between the definition of the interpretive approach given above and the one given for positivist research. Ontologically, interpretive researchers believe that reality is subjective and multiple, and is based on construction of the human mind shaped by experiences of the world (Guba and Lincoln, 1994). Stated differently, this school of thought takes the position that people create and attach their own meanings to the world around them through interactions and discussion (Allen S. Lee, 1991). Consequently, at the epistemological level, interpretive researchers seek to understand reality by being in the field in direct, experiential contact with the phenomenon under investigation. Therefore, no predefined variables are set; rather they are developed inductively as significant themes emerging within the field of study. As the purpose of an interpretive study is to understand a phenomenon through the eyes of individuals, it is value-laden, and recognises the existence of bias. At the level of methodological stance, this type of study should have the characteristics of being hermeneutical and dialectical (Guba and Lincoln, 1994). Finally, on the issue of rhetoric, interpretive researchers may opt for the first person and personal style of language.

Interpretive IS research acknowledges that an information system is a socio-technical system where its development, implementation and use not only purely involve technical perspectives but also concern people. Therefore, the IS interpretivist accepts that the social world presents a better ground through which these phenomena can be researched and studied. The interpretivist also believes that active involvement in the field is necessary in order to capture and understand the richness of interactions relating to IS development, implementation and use in organisations. However, being objective and existing independently of the investigated

object, the positivist researcher could not possibly capture these constructs. Thus, the strength of the interpretive approach from this perspective is to help researcher to obtain a more holistic point of view of social phenomenon. Consequently, permitting a better understanding of the different facets of IS in organisations.

Just as all research approaches have limitations, so does interpretive research. Nandhakumar and Jones (1997) listed several limitations of interpretation that might influence the quality of the research:

1. The researcher might incorrectly interpret the subject's interpretation if they are from different social and cultural conditions;
2. There may be a difference between what is said and what is done;
3. There may be secrecy in social interaction; and
4. Subjects might not be able to give an account of their actions since behaviours form part of social routines which the researcher may not be fully aware of.

However, Klein and Myers (1999) argued that if an interpretive researcher follows the seven underlying interpretive research principles, a high quality study can be anticipated. The following principles were included:

1. the hermeneutic circle – suggests that people understand a complex whole from the meaning of its parts and their interrelationships;
2. contextualisation – requires that interpretive researchers provide details of social and historical background of the subject matter since the context plays a vital role in attributing meaning to a particular action;
3. interaction between the researchers and the subjects - recognises that research data are socially constructed through the interaction between the researchers and the participants; hence, interpretive researchers are cautioned regarding potential confounding of data;
4. abstraction and generalisation - emphasises that interpretive researchers relate the details revealed by the data interpretation to general concepts or theories that explains the nature of human understanding and social action;
5. dialogical - asserts that interpretive researcher should be sensitive to the possibility of conflicts between the theoretical preconceptions guiding the research design and the actual findings;

6. multiple interpretations - encourages the interpretive researchers to obtain and document multiple views of the same phenomenon in order to understand the truth; and
7. suspicion - requires that interpretive researchers to be aware of the possible biases and distortions in the stories collected from the participants.

So far, this thesis has outlined two influential paradigms in the IS research that are based on the five philosophical assumptions and has discussed the associated advantages and disadvantages. The following section provides the justifications for choosing the interpretive paradigm for this study.

4.1.3 *The justifications of choice of approach*

Up to this point, this section has outlined some of the main principles surrounding the two popular paradigms within IS research and has discussed their associated strengths and weaknesses. This section is concerned with the rationale for choosing the interpretive paradigm as the appropriate approach for this research. The researcher is aware that there is no single paradigm that is intrinsically better than others (Benbasat *et al.*, 1987) and there is also the option of adopting the multi paradigm approach (Kaplan and Duchon, 1988; Mingers, 2001). Therefore, the choice of paradigm for this study was made with an open mind. According to Oates (2006), the decision on the selection of paradigm is basically based on the problem under consideration, the research context, the researcher's personal beliefs and values and the researcher's willingness to take risk and challenge the status quo.

This research is mainly concerned with understanding the research students' needs toward an e-learning system in a blended learning environment. This leads to multiple explanations. Epistemologically, this does not favour positivism which assumes that there should be only one generalisable explanation of truth. Therefore, the interpretive paradigm is considered to be the most appropriate option since the research questions aim to explore research students' opinions and views. Ontologically, the interpretive paradigm aligns with the research context, which is based upon the social interaction with a number of different actors, all of which have their own interpretations of reality. Taking a positivist approach to this study would have been possible; however, the desired richness of explanations and the messiness of real life situations would not be wholly captured. In terms of personal belief, the author's worldview

has been shaped through the research process and the interactions with the literature, colleagues and supervisors. At the beginning of the research, because of the author's background and experience of research, she believed that only one objective truth can be found (positivism paradigm). However, in being exposed to the literature concerning paradigmatic issues, this worldview changed. Furthermore, the social reality in which this research is situated has prompted the thought that reality is subjective, and dependent on individuals. Therefore, the interpretive paradigm was adopted for this work.

The following table summarises the comparisons of five philosophical assumptions held by positivists, interpretivists and this research.

Assumptions	Questions	Positivist	Interpretivist	*This Research*
Ontological	What is the nature of reality?	Reality is objective and singular, separate from the researcher.	Reality is subjective and multiple, as seen by participants in a study.	*There are multiple realities. Reality can be explored and constructed through human interactions and meaningful actions.*
Epistemological	What is the relationship of the researcher to that researched?	Research is independent from that being research.	Research interacts with that being researched.	*Researcher and that being research are interlocked in an interactive process of talking and listening.*
Axiological	What is the role of values?	Value-free and unbiased	Value-laden and biased	*Report researcher's values and biases as well as value-laden of information gathered.*
Rhetorical	What is the language of research?	Formal; based on set of definitions; impersonal voice; use of accepted quantitative words.	Informal; evolving decisions; personal voice; accepted qualitative words	*Informal as well as the words used by participants.*
Methodological	What is the process of research?	Deductive process. Cause and effect. Static design – categories isolated before study. Context-free. Generalisations leading to prediction, explanation, and understanding. Accurate and reliable through validity and reliability.	Inductive process. Mutual simultaneous shaping of factors. Emerging design – categories identified during research process. Context-bound. Patterns, theories developed for understanding. Accurate and reliable through verification.	*Data is collected through interviews, focus groups and is reflected upon. Research is a product of the values of the researcher.*

Table 17 – Paradigm comparison table adapted after Creswell (2003). Original work modifications are italicized.

4.2 Research Methods in E-learning

In this part of the chapter, those research methods that have been adopted to examine the e-learning phenomenon are reviewed. This is followed by a discussion of the research strategy chosen.

In the previous chapters, various research methods were used to investigate the application of web-based technologies in supporting the learning and supervision of research students. In this chapter, the studies are revisited again but research methods are the focus. Table 18 summarises the research methods that have been employed in studies involving the use of web-based applications to support the processes of research study. The next subsections provide a more detailed discussion of each method.

Research Methods	E-learning studies
Field Experiments	(López Alonso *et al.*, 2008)
Survey	(Lim *et al.*, 2008; Lawlor and Donnelly, 2010; Meyer, 2010; Rockinson-Szapkiw, 2011)
Case Studies	(Lotia and Teasley, 2005; Martin and Woods, 2008; Chong, 2010; Thomson and Allan, 2010)
Action research	(Rossana Espinoza and Hammond, 2008; Joyes and Banks, 2008; Carmichael and Burchmore, 2010)

Table 18 – A summary of research methods in e-learning studies

4.2.1 *Field experiments*

According to the analysis of the literature in the preceding section, the field experiment was the least frequently used method for investigating the use of e-learning applications to support the processes of research. Benbasat et al. (1987, p. 370) argued that the field experiment approach involves "the manipulation and measurement of clearly defined variables, but in a natural setting". In a field experiment, the researcher is able to focus on particular factors that they are interested in. Furthermore, it allows researcher to define both independent and dependent variables in advance in order to investigate some pre-determined hypotheses (Piccoli *et al.*, 2001). However, there are some problems with this type of research method. In general, this method suffers from the same criticisms of the positivist research approach, for example, the problems related to the use of statistical analysis (such as multivariate complexity and normality) (Benbasat *et al.*, 1987) and the exclusion of contexts, meanings and purposes (Guba and Lincoln, 1994). Mason (1992, p. 111) argued that although the results from field experiments can offer some useful insights into certain phenomena, but "the real complexities of educational issues are not addressed".

4.2.2 *Surveys*

In contrast, surveys were found to have been widely adopted in the e-learning research, particularly within the North American studies. A survey is a means of providing "a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population" (J. W. Creswell, 2003, p. 153). Pinsonneault and Kraemer (1993, p. 78) argued that a survey was most appropriate when:

1. The central questions of interest about the phenomena are 'what is happening?' and 'how and why is it happening?' Survey research is especially well suited for answering questions about what, how much, and how many, and to a greater extent than is commonly understood, questions about how and why;
2. Control of independent and dependent variables is not possible or not desirable;
3. The phenomena of interest must be studied in their natural setting;
4. The phenomena of interest occur in current time or the recent past.

An example of survey research in the e-learning area is the work of Rockinson-Szapkiw (2011). She adopted survey research to investigate the use of Microsoft Office SharePoint as a collaborative workspace to support the dissertation process. Lucas (1991, p. 124) suggested that this type of survey was useful but it did not do much to advance the perceived quality of research in the IS field. In contrast, survey research devoted to finding causal relationships among variables counted more to research contributions in the IS field (Henry C. Jr. Lucas, 1991). However, this type of survey was not found in the e-learning area that has specifically investigated research students' perspectives. Nevertheless, when looking at the broader e-learning area, this type of research is common. One example is the work of Webster and Hackley (1997) who investigated the factors that affect student learning outcomes in technology-mediated distance learning.

Gable (1994) outlined a number of strengths and weaknesses related to the use of survey research. The main advantage of survey research is that with a large sample size and well-formulated hypotheses, survey results could provide valid and reliable quantified results. In addition, Jick (1983) commented that survey research may also contribute to greater confidence in the generalisation of the results and thus achieve higher external validity (Jeffrey W. Lucas, 2003). However, Bryman (2001) maintained that without large enough

samples, or the use of secondary data, the quality of such research might be jeopardised. Moreover, high quality survey research also relied on the development of compelling hypotheses and on the wording of the questionnaire (A. Bryman, 2001). If these two stages of research design are not carefully constructed, then the research will receive poor and biased survey results. McGrath (1982) also criticised the inability of the survey method to disclose the contexts in which research studies are conducted.

4.2.3 *Case study*

In the information systems area, particularly relating to technology adoption topics, case studies were found to be widely used when examining adoption issues at an organisation level (Choudrie and Dwivedi, 2005). In contrast, a review of the literature in the e-learning areas that has related to research students, it was found that only a small number of researchers have used the case study approach. An example of e-learning research that adopted case design is the work of Chong (2010). Using the case research approach, Chong (2010) examined the use of blogs as a means to develop students' research skills and understanding.

Hsu (2002) argued that the value of the case study method is that it enables researchers to focus on a specific instance or a situation and to perform an intensive examination of a small number of entities in order to develop deep insights of a particular e-learning setting. MacNealy (1997) further pointed out that the in-depth focus can help provide:

- a holistic view of an event that includes the contexts as well as the details of an individual situation;
- rich detail that can lead to a more complete understanding of some aspects of people, groups or organisations;
- sentimental information that cannot otherwise be collected; and
- a more precise definition of a research question. Case studies are often used to explore problems that are not well-defined. In such instances, the case study can identify hypotheses that can be tested in follow-up experiments.

In addition to providing holistic understanding of a complex situation, case studies can be used to generate theory (Yin, 2003). Eisenhardt (1989) stated that theory developed from case study research is likely to have important strengths, such as novelty, testability, and empirical validity. However, case studies are not without disadvantages. Case research can be difficult

to generalise, especially when only a single case is used (MacNealy, 1997). At the same time, Yin (2003, p. 31) argued that analytic generalisation rather than statistical generalisation is an appropriate method for generating theory from case studies, by which he meant that, "a previously developed theory is used as a template with which to compare the empirical results of the case study. If two or more cases are shown to support the same theory, replication may be claimed".

From an interpretive stance, Walsham (1995) proposed four possible ways of generalising results, through the development of concepts, the generation of theory, drawing of specific implications and the contribution of rich insights. In terms of conceptual development, Walsham (1995) referred to Zuboff's (1988) study that illustrated how information technology not only automates but also 'informates'. He further argued that the work of Orlikowski and Robey (1991) served the purpose of generating new theory relating to system developments (Walsham, 1995). Finally, Walsham (1995) demonstrated that by using an in-depth case study on the development of information systems in a financial service company, Walsham and Waema (1994) were able to draw several implications from the case study findings.

4.2.4 *Action research*

Action research is a form of applied research, where a researcher aims to both improve the subject of the study and develop theoretical knowledge, achieving both at the same time. Hult and Lennung (1980, p. 247) provided a comprehensive definition of action research:

> "action research simultaneously assists in practical problem-solving and expands scientific knowledge, as well as enhances the competencies of the respective actors, being performed collaboratively in an immediate situation using data feedback in a cyclical process aiming at an increased understanding of a given social situation, primarily applicable for the understanding of change processes in social systems and undertaken within a mutually acceptable ethical framework".

Based on the definition of Hult and Lennung (1980), six common characteristics of action research that received widespread agreement among action research authorities can be identified. First, the aim of action research is to increase the understanding of an immediate social situation, with the emphasis on the complex and multivariate nature of the social

setting. Second, action research has the dual intentions of both contributing to theory (scientific knowledge) and improving practice (practical problem solving). Third, it is normally participatory or collaborative in nature. The process of collaborative action research provides a learning environment that enhances each actor's competence. Fourth, action research is appropriate for a study that intends to understand change processes in social systems. Fifth, it involves a cyclical process of problem definition, action planning, implementation, data feedback and evaluation. Last, it is undertaken within a mutually ethical framework.

The action research process typically occurs as a spiral of sequential research cycles. An example is the model proposed by Susman and Evered (1978). They presented a diagrammatic model, as shown in figure 17, involving five stages: diagnosing, action planning, action taking, evaluating and specifying learning. Diagnosing refers to the identification and improvement opportunity in the client organization. Action planning involves collaborating with the client organization to specify actions that should improve the problem identified. Action taking phase implement the planned action previously determined. The evaluating stage involves determining whether the theoretical effects of the action were realized. Finally, the specifying learning considered as an ongoing process that involves identifying important knowledge gained through the process. This knowledge will in turn provide relevant theoretical assumptions for the scientific community when faced with future research settings.

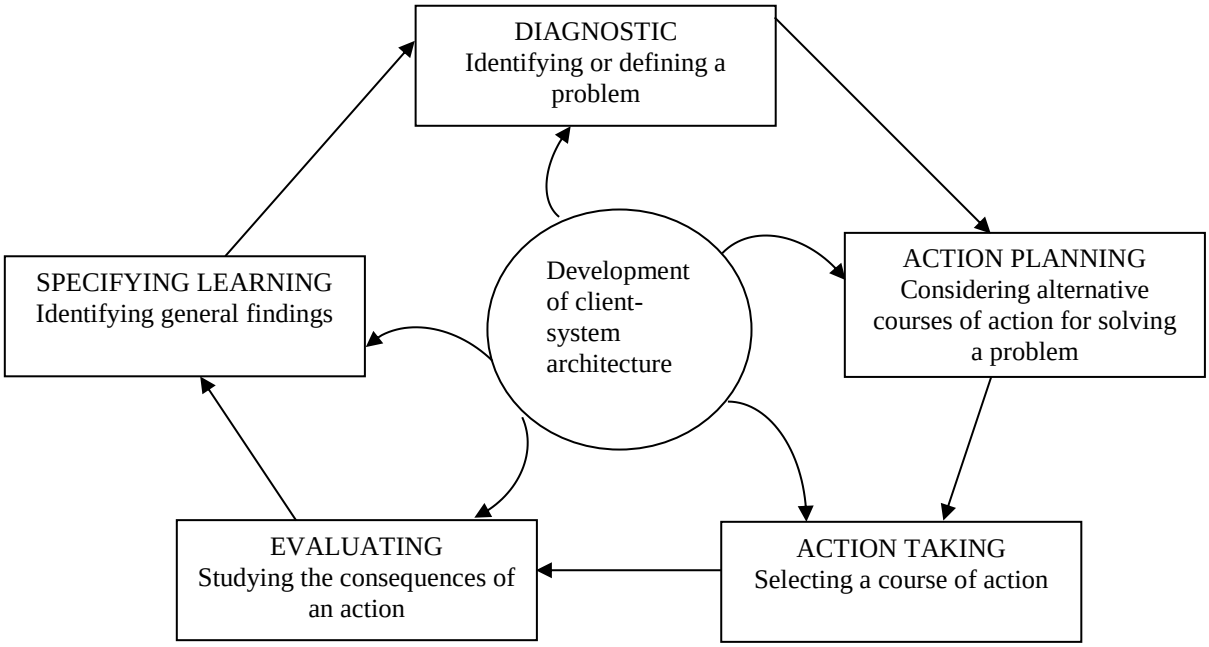


Figure 17 – The cyclical process of action research (Susman and Evered, 1978)

Within information systems research, action research was once considered to be the least common research strategy (Chen and Hirschheim, 2004). According to Chen and Hirschheim (2004), only 2% of the 1893 articles published in eight major information systems publication outlets (such as MIS Quarterly, Information Systems Research, etc.) between 1991 and 2001 used action research as their research approach. However, Papas et al. (2012) argued that interventionist research method (such as action research) have matured and grown to become acceptable approach for information systems researchers over the past 15 years. A review of the literature on e-learning specifically for supporting research learning found that action research was quite popular if compared to field experiment approach (see table 18). Using action research design, Espinoza (2008) explored the opportunities and constraints in the use of ICT to support collaborative practice in doctoral study. She found that action research enabled her to take an incremental approach to introducing and implementing online support for doctoral students.

Despite its lack of popularity within the IS field, action research is useful when researchers want to make their research more relevant to practice. In this instance, action research appears as an appropriate method for the questions addressed in this thesis. Furthermore, it fitted with the author's interpretive philosophical beliefs and offered the opportunity for active intervention.

In summary, this section has provided an overview and a brief discussion of the benefits and problems of common research methods for examining e-leaning issues. The next section presents the research strategy adopted by this thesis and the justifications for selecting this strategy.

4.3 The Research Strategy

At the beginning of this chapter, it was indicated that an action research approach was chosen as the research strategy for this thesis. This section, therefore, discusses in more detail the historical background of IS action research and its nature and principles with the intention of providing a framework into which the action research employed can be appraised. Finally, the identification of its strengths and limitations and justifications for using the action research approach follow the analysis.

The origin of the term 'action research' is generally attributed to the work of Kurt Lewin (1946), a social psychologist based in the United States of America (Lau, 1997). However, at the same time, there are other researchers (such as (Corey, 1953) and (Collier, 1945)) also calling for similar action oriented approaches to research (Davison, 1998). In the UK, the development of action research was started by the Tavistock Institute (formerly known as Tavistock Clinic) after the Second World War (Baskerville and Myers, 2004). Action research was introduced to the IS field through the early work of Mumford and Weir (1979) as a systems development technique called Ethics. However, it was Wood-Harper (1985) that explicitly established action research as a research methodology for the IS community (Baskerville, 1999).

4.3.1 *Forms of action research*

In terms of action research practices, there are varied forms that grew out of very different traditions (Herr and Anderson, 2005). It is not the intention of this thesis to provide detail accounts of each forms' grounding, but it will only review commonly recognised action research forms so as to show the different kinds of choices that can be creatively draw upon. Furthermore, this review could shed some light on the choice of action research practices that this research is attributed to.

Many authors have attempted to classify and analyse action research into various forms and from different perspectives. One approach is through developing taxonomy of action research

forms based on specific characteristics. For example, Lau (1997) came out with a four-class taxonomy which includes action research, participatory action research, action science and action learning. On the other hand, Reason and Bradbury (2001) made a wonderful effort by editing a comprehensive collection of research practices from a wide range of authors. They compiled at least 10 exemplar action research practices in addition to the grounding of various action research traditions. Other researchers that have contributed to the identification and classification of action research forms includes Baskerville and Wood-Harper (1998) where they inventoried 10 distinct forms of action research: canonical action research; information systems prototyping; soft systems; action science; participant observation; action learning; Multiview; ETHICS; clinical field work and process consultation.

For the purpose of this research, only four widely recognised action research that appeared in Lau (1997), Reason and Bradbury (2001) and Baskerville and Wood-Harper (1998) are reviewed including classical (canonical) action research (Davison, Martinsons & Kock, 2004), action learning, action science and participatory action research (Bradbury and Reason, 2001). The generalised action research model discussed in section 4.2.4 is a form of canonical action research. This form of action research is associated with cyclical, rigorous iterative process that is conducted in collaboration with practitioners to achieve the dual intentions of organisational development and the generation of knowledge (Baskerville and Wood Harper, 1998; Davison, Martinsons & Kock, 2004). The rigorousness of this form is characterised by the iterative nature of the research process as researcher and practitioner engage in collaborative cycles of diagnosing, planning, action taking, evaluating and learning. In terms of collaboration, it was observed that researchers and practitioners assumed appropriate roles and practitioner's knowledge and expertise was valued (Marshall et al., 2006, Baskerville and Wood Harper, 1998; Davison, Martinsons & Kock, 2004).

The term 'action learning' was first introduced and coined by Reginald Revans (1907-2003), who was an academic professor, administrator and management consultant (Pedler, 2011). Generally, action learning is an approach to address organisational or societal problems through "a highly structured, facilitated team process of reflection and action" (Ruebling, 2007, p. 1). In action learning, both researchers and practitioners reflect and learn with and from their experiences and actions and consequently used their learning to implement changes in organisational and individual practices (Popplewell and Hayman, 2012). In addition to iterative cycles of planning, action, evaluating and learning, Baskerville and Wood-Harper

(1998) argue that the process model of action learning is more of a 'reflective' nature where it focuses more on revealing personal understanding of action taken, rather than primarily on the personal beliefs or value of what is right. In terms of research collaboration, both researchers and practitioners assume distinct tasks but the burden of solving the immediate problem rests with the researcher (Baskerville and Wood-Harper, 1998).

Drawing on double-loop organisational learning (Argyris and Schon, 1978) and reflective practice (Schon, 1983), Argyris et al. (1985) pioneered the form of action research called 'action science' (Baskerville and Wood Harper, 1998). This form places emphasis on understanding practitioners' hidden beliefs that drive their actions (Raelin, 1999). Action science calls for deliberate questioning of espoused-theories (a practitioner's beliefs, attitudes and values) against theories-in-use (the theory that a practitioner actually employed). When a mismatch occurs between espoused-theories and theories-in-use, most people tend to narrow the gap by trial and error learning. However, in action science the theories-in-use are subjected to critical reflection to uncover which theories-in-use inhibit and which promote learning (Argyris, 1995). In contrast to action learning, practitioners in action science are the person responsible for solving the immediate problem. Nevertheless, they acquire help from the researcher in terms of expert advice, technical knowledge or an independent viewpoint. In other words, while the work is cooperative, the researcher assumes the role of an expert in this form (Baskerville and Wood Harper, 1998).

Participatory action research (PAR) differs from canonical action research, action science, action learning in that it typically takes place outside of the organisational context (Coghlan and Brannick, 2010) where it involves empowering powerless individuals such as the exploited, the poor, the oppressed and the marginalised (Selenger, 1997). The goal of PAR is to generate sustainable solutions to social problem that relies on local capital and resources and working with existing cultural practices and local organisations (Wilk, 1996). In term of researcher involvement in PAR, the researcher is a committed participant and learner in the process of research (Hall and Kidd, 1978). However, the subject of the research originates in the community itself and requires an active involvement of the community to define, analyse and solve the problem (Hall and Kidd, 1978).

Having discussed the four commonly forms of action research, it is clear that this study is attributed to canonical action research. There are three reasons why canonical action research

is suitable for this study. First, the iterative process model fit well with the aims of this study of designing an information infrastructure to support research programme through cycle of information system prototyping. Second, both the researcher and research subjects (in this case the research students) assume appropriate roles in the action research – the subjects bring in their expertise in identifying information and technological requirements while the researcher mediate the requirements to the development team. Third, the dual aims of organisational development – in this case the design of an information infrastructure – and general of knowledge – in this case the lessons learned from the process of providing support to research students through an action research study.

4.3.2 *Criteria of quality of action research*

Reason and Bradbury (2001, p. 1) argue that although the practices of action research are varied, they share five common features in terms of its purpose, concern on practical issues, participation, practical knowledge and emergent developmental form. This is embedded in their definition of action research:

> Action research is a participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in a participatory worldview which we believe is emerging at this historical moment. It seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and their communities.

The ultimate aim of action research is to produce practical knowledge. This practical knowledge serves three purposes. First, it is useful to people in the conduct of their everyday life. Second, it increases the well-being of human persons and community in terms of economic, political, psychological and spiritual. Third, it consequently contributes to a more equitable and sustainable relationship with the wider community in which we are a part (Reason and Bradbury, 2001).

Action research is an approach that concerns with producing both practical outcome and a new form of understanding. Theories produced in action research that contribute to human emancipation and flourishing of community could allow us to reflect on our role in the community as well as our spiritual purposes and thus could lead us to learn how to live together and to provide important guidance and inspiration for practice (Reason and

Bradbury, 2001).

Action research is essentially a democratic, participative type of research. It involves working with, for and by people or communities. Action research without participation of those who experience the problem is meaningless since we cannot simply improve the situation affected without necessary perspective and information from those involved. According to Reason and Bradbury (2001), participation in action research is also an ethical and political process. It allows people to contribute not only in terms of the knowledge about them but also the decision that affected them. Furthermore, action research supports empowerment of people.

Reason and Bradbury (2001) believe that action research is a living and an emergent process. One criterion for a good action research is that it emerges over time as communities of inquiry develop within communities of practice. This means that the process of inquiry is evolutionary and developmental in that it cannot be pre-determined but evolves as those engaged deepen their understanding of the issues to be addressed and develop their capacity to reflect and learn both individual and collectively. Thus, choices about quality at the beginning of the enquiry may differ from the choices made at a later stage.

4.3.3 *Action research strengths and limitations*

The key strength of action research lies in its focus on generating solutions to practical problems, whilst contributing to theory (Hult and Lennung, 1980). Unlike laboratory experiments that struggle to maintain relevance to the real world, action research has the benefit of informing practice through research, since its 'laboratory' is the real world setting. Baskerville and Wood-Harper (1996) pointed out three main reasons why action research is well-suited as a method of information systems enquiry: 1) information systems is a highly applied field whereas action research is clinical (combine research and praxis) in nature, thus this conducive relationship places IS researchers in a 'helping-role' within the organisations being studied; and 2) action research supports rigorous intervention. In other words, this method not only allows IS researchers to research their own practice, but it also introduces changes and allows their effects to be studied; 3) since action research aims to contribute to theory and practice it can immediately apply the knowledge gained to practice. Thus, the issue of relevance is less problematic.

Nonetheless, action research is not without its weaknesses as a research approach, nor is it

without its critics. Of those that are most often identified are the following: 1) the issue of lacking subjectivity and of rigour in data collection and analysis; 2) the problem of generalising findings; and 3) the differentiation between research and consultancy. Baskerville and Wood-Harper (1996) argued that the lack of researcher impartiality has led to the rejection of the action research method by positivist researchers. However, this criticism is not solely attributed to action research, but also to other qualitative research methods such as case study research and ethnography (Patton, 2002). In terms of potential sources of bias that could influence the researcher's task, Miles and Huberman (1994, p. 256) cautioned researchers about "(a) the effects of the researcher on the case and (b) the effects of the case on the researcher". Regardless of the researcher philosophical stance, it was recognized that both biases are difficult to avoid; however, actions to reduce the level of biases should be undertaken. For example, the researcher can prolong the time spent at a site and ensure that the participating actors have a clear understanding of the purpose and the research method to be used (Miles and Huberman, 1994). Another strategy that can be employed is that triangulation of data, in order to minimise the impact of the researcher's own subjectivity on research quality (Berg, 2001). Data collected through different methods can be compared and contrasted to eliminate errors and identify omissions caused by the researcher's own perceptions. Furthermore, Kock et al. (1997) argued that the iterative and cyclical processes employed by action research adds scientific rigor to action research.

The problem of generalising research findings is the second criticism that researchers face when adopting the action research method. Avison et al. (2001) argued that the limitations of action research in terms of generalisation is associated with its highly situational or idiosyncrasy features. Consequently, general 'laws' cannot be developed for action research implementation. There have been various responses to this criticism in the literature. For example, Lincoln and Guba (1985) proposed the notion of transferability, in which findings are not generalised, but instead transferred from a sending context to a receiving context. The following excerpt shows Lincoln and Guba (1985, p. 298) views on the generalisation of qualitative findings:

> "If there is to be transferability, the burden of proof lies less with the original investigator than with the person seeking to make an application elsewhere. The original inquirer cannot know the site to which transferability might be sought, but the appliers can and do. The best advice to give to anyone seeking to make a transfer is to accumulate empirical evidence about contextual similarity; the responsibility of the

original investigator ends in providing sufficient descriptive data to make such similarity judgements possible".

The last difficulty related to action research is to differentiate between consultation and research. Consequently, this sometimes leads to the questioning of whether action research findings contribute to the academic knowledge. Baskerville and Wood-Harper (1996) suggested that there are four features that distinguish between action research and consultancy. First, research requires more thorough documentation than consultancy. Second, research aims to achieve theoretical rationalisation whereas consultancy is usually empirically grounded. Third, action research is cyclical but consultancy tends to be linear. Last, a consultancy project tends to have stricter deadlines and financial constraints while an action research is not.

Having weighted up the associated advantages and disadvantages of the action research approach, and taken into account their nature, this thesis considers that action research is well-suited for the purpose of this research in comparison to other methods. The decision was based upon the following reasons. Firstly, the characteristics of action research including its iterative focus and potential for involvement suited the objective and development nature of this study. This study aimed to design an information infrastructure to support research students, the supervisor, the graduate schools and the administrators. As such, it involved an iterative cycle of diagnosing, action planning, action taking, evaluating and specifying learning. In addition, action research enables the researcher to collaborate with participants in contributing to the change processes according to their respective knowledge and expertise. Unlike other methods that supported the study of technology in its natural setting, action research distinguishes itself in that it is interventionist and dedicated to the development of knowledge useful to both research and practice. Since the action element is present in this study (by the fact that technology is introduced to research students), action research was deemed the appropriate approach.

Second, action research allows a strong link between theory and practice. The aim of this study was not only to identify the requirements of research students but also to propose solutions that could meet their requirements. This aim is in line with action research principles. Mathiassen (2002) argued that action researchers view their responsibility to assist practitioners by developing and applying knowledge.

4.4 Data Collection Techniques

In the previous sections, the nature and the types as well as the strengths and weaknesses of action research has been examined in detail. The reasons for choosing action research as the appropriate research strategy for this thesis have also been discussed.

This section covers the data collection methods and analysis that the thesis adopted. After studying a wide range of qualitative research methods, and in conjunction with the recruiting participants, the researcher finally adopted two interview methods - group and individual interviewing. According to De Groot (2002), using qualitative interviewing as a method for gathering data was appropriate for the purposes of this research. The qualitative interviewing techniques attempted to gain an in-depth understanding of the users' requirements towards an e-learning portal from the research students' perspective, which means that participants' "subjective view is what matters" (Marshall and Rossman, 1999, p. 110). Furthermore, following Herr and Anderson (2005)'s suggestions to use multiple sources of information in the action research strategy, this research also includes documents and observations as the data collection strategy. The following sections describe each of these methods in detail.

4.4.1 *Non-verbal observation: field notes*

Silverman (2000) argued that there are two reasons for taking field notes. First, it is a concern with what participants claimed to be routine or obvious. Second, routine is best established through watching and listening to what people does rather than asking them directly. Therefore, field notes were only used in this study as supportive material, and provided information for the findings of action research cycles.

4.4.2 *Focus group*

According to Bryman and Bell (2007, p. 511) a focus group is

> "a form of group interview in which: there are several participants (in addition to the moderator/facilitator); there is an emphasis in the questioning on a particular fairly tightly defined topic; and the accent is upon interaction within the group and the joint construction of meaning".

According to this definition, two main points were emphasised, specific topic and interaction. This method aimed to acquire information on particular issues from participants that have experienced, or are involved in that particular situation under study. Compared to an individual interview, a focus group has an added advantage where the interaction among participants will help them to respond to each other's view, and thus build up a collective perspective.

Kruger and Casey (2000, p. 19) argued that

> "Focus groups have been found useful prior to, during, and after programs, events or experiences. They have been helpful in assessing needs, generating information for constructing questionnaires, developing plans, recruiting new clientele, (and) finding out how customers make decisions to use or not use a product or service, testing new programs and ideas, improving existing programs, and evaluating outcomes".

In this study, focus groups were used in two stages: first to assess the requirements of research students for a postgraduate research portal and second, to assess the research students' perspectives on the postgraduate portal.

Focus group participants were described by Krueger and Casey (2000, p. 27) as "people, who possess certain characteristics, provide data of a qualitative nature in a focussed discussion". Qualitative research is often said to provide the facts and hypotheses to be later validated by quantitative methods. Patton (1987) discussed the difference between quantitative and qualitative sampling studies. He argued that the strength of a focus group lies in selecting information-rich cases by purposeful sampling for an in-depth study.
Focus groups were discussed over a decade ago (Julius Sim, 1998), but recognition of their value only came later. The technique has several advantages:

(a) Kruger and Casey (2000) argued that a focus group is an economical way to elicit views of several people in a short time because respondents are interviewed in groups rather than one by one;
(b) Morgan (1988) suggested that focus groups provide information on the dynamics of attitudes and opinions in the context of the interaction that occur between participants;
(c) Butler (1996) noted that focus groups may encourage a greater degree of spontaneity in the expression of views than other methods of data collection;

(d) Vaughn et al. (1996) believed that focus groups can provide a safe forum in which participants can express their views;
(e) Finally, Peters (1993) argued that participants may feel supported and empowered by a sense of group membership and cohesiveness.

Despite the advantages discussed above, there are potential weaknesses in focus groups that merit researchers' consideration. First, if accidentally choosing participants who do not like to speak in groups, the moderator may have difficulty in eliciting their views (Horowitz *et al.*, 2003). Second, the quality of data obtained may be reduced if a moderator fails to manage group dynamics effectively (Horowitz *et al.*, 2003). Third, attitudinal consensus cannot be inferred and strength of opinions cannot be judged accurately from the data collected (Julius Sim, 1998). Fourth, statistical generalisation from the data is unlikely. However, Sim (1998) argued that generalisation from focus group data is possible, but in different ways from conventional quantitative approaches to research. Finally, the presence of some people may constrain the openness of others (Krueger and Casey, 2000).

The focus group technique has been used for a wide range of purposes, including marketing research, evaluation of political candidates, and mock trials to anticipate jury deliberations. Focus group interviews have also been used to evaluate usability issues or elicit user requirements which are suited with this study.

4.4.3 *Interview*

Gray (2004, p. 213) defined an interview as "a conversation between people in which one person has the role of researcher". Interviews can be categorized into three types: structured; focused or semi-structured and unstructured interview (Punch, 2005). Structured interviews use a series of pre-established questions with preset response categories. In this sort of interview, flexibility and variation are minimized whilst standardization is maximized. On the other hand, in semi-structured and unstructured interviews standardization is minimized. Semi-structured interviews are often used in qualitative analysis (Gray, 2004). The interviewer has a list of themes and questions to be covered, but these may vary from interview to interview. Additional questions may also be required as new issues arise during the interviews. Unstructured interviews have the most flexibility in terms of the set of questions to be asked. There is no predetermined list of questions to be covered; however, the interviewer must be clear which aspects to explore. Typically, the interviewee is given the

opportunity to talk freely about events, behavior and beliefs in relation to the topic area.

4.5 Research Framework

Having discussed the research strategy, as well as the data collection techniques and data analysis in the previous sections, this part of the thesis presents the research framework for this study. As shown in figure 18 the first and second objectives were achieved by conducting a literature review on various models of the research degree process and consulting with relevant research degree's documentation. Research students' information requirements were identified through a documentation process, which was used as a basis for the development of the prototype portal. The researcher used the prototyping method to develop the prototype portal. The prototype portal was subjected to design and evaluation through a cycle of iterative action research approach. Revised user requirements and an e-learning model were produced after each cycle of action research. At the end of the action research cycle (cycle four) a validated e-learning model for supporting research students in a blended learning environment together with the finalised prototype of postgraduate research portal was produced.

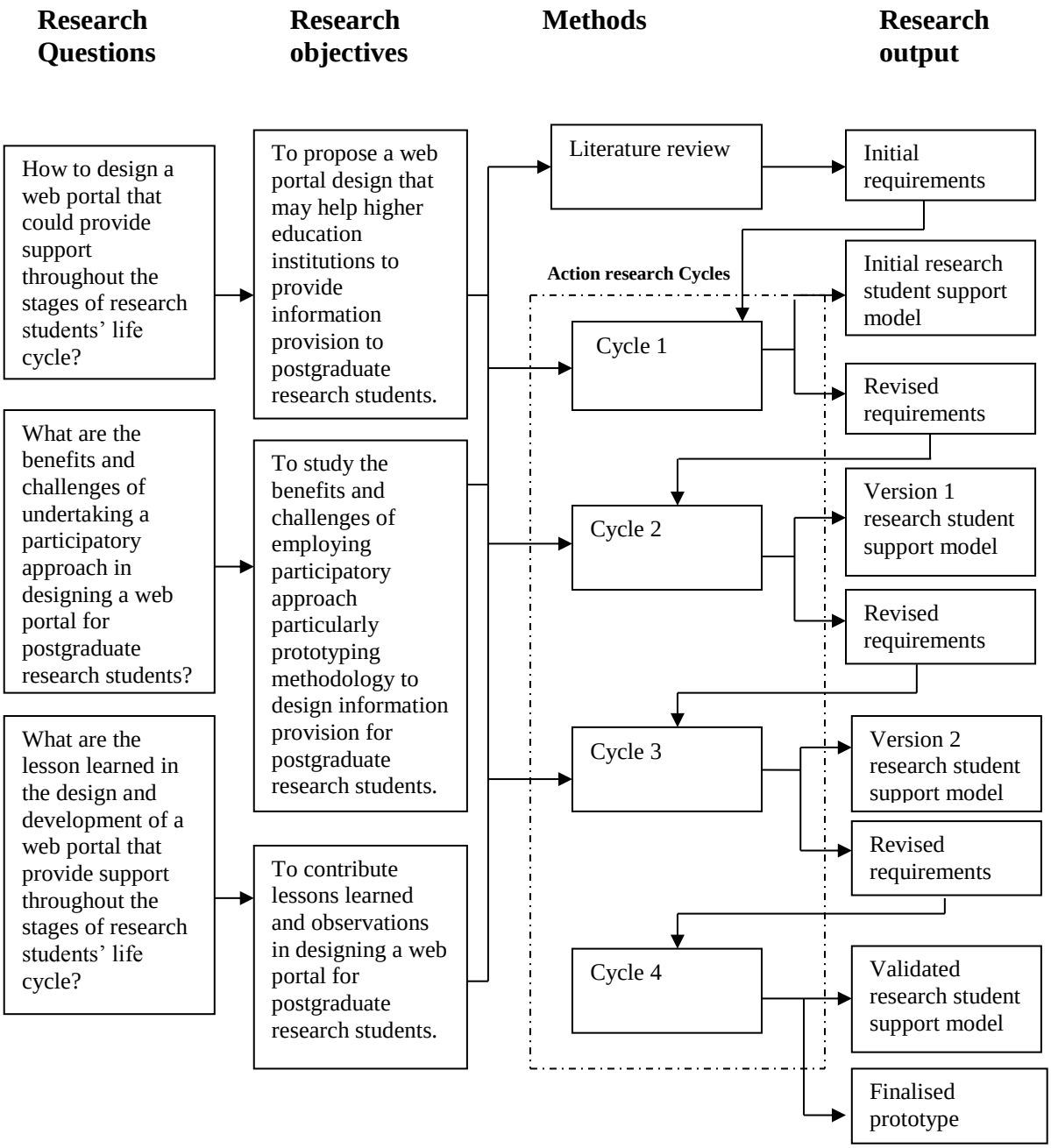


Figure 18 – Research framework

4.6 Summary

In summary, this chapter has explored the broader context of scientific enquiry, and identified the philosophical orientation of the study as being interpretivist. The research methods were considered, and a rationale for selecting an action research strategy was justified. Having set out the theoretical underpinnings of the study, the techniques of data collection were presented. The chapter concluded by presenting the research framework for this research. This chapter concludes with table 19, offering an outline of the overall research design of this study.

Research Design	Description of choices
Research Questions	How to design a web portal application to support research students throughout their research life cycle
Philosophical orientation	Interpretivism (see table 17 for details)
Research strategy	Interpretive action research
Data collection methods	Focus groups Interviews Observations Document analysis
Data analysis techniques	Thematic analysis

Table 19 – Summary of the research design

The next chapter presents the implementation of the research methodology.

Chapter 5. Methodology: Implementation

This chapter lays out a detailed account of the implementation of the research strategy. The aim is to provide a 'rich description' of the conduct of this research.

This chapter is organised into three sections. Since the interpretive approach assumes that knowledge is context bound, section 5.1 describe the setting in which the research is conducted. The description includes the institutional context and the participants. It also outlines the roles and responsibilities of the people (including the researcher) involved in this project. This is followed by the description of how action research was implemented, as well as the management of its limitation. This chapter ends with an explanation of data collection and analysis process, as well as a summary in section 5.3.

5.1 Description of the Research Setting

The underlying epistemological assumption of interpretive research is that the nature of knowledge is subjective, and the construction of knowledge is subject to individuals' interpretation in a context in which interaction with others takes place. In line with this belief, this research also views knowledge creation as subjective where the research context, the researcher's roles and participants' background will influence the knowledge created. Therefore, to familiarise readers with the 'rich details', this section provides a description of research context, the researcher's roles and the participants' background. Since anonymity was required in this research, the descriptions of the participants are generic and unspecific, with the intention that their identity is not revealed.

5.1.1 *Description of the context of the study*

The study was conducted at Newcastle University, a public higher education institution in the North East of England. The research students attending the three faculties at the University were invited to take part in the research. Overall, forty eight research students participated in the study. To ensure multiple perspectives were captured, research students who participated came from diverse backgrounds: both modes of study (part and full time); registration status (home student, European Union and international); both genders (female and male); all three faculties within the university (Humanities and Social Sciences, Science Engineering and

Agriculture and Medical Sciences faculties) and each stage of research (first, second, third, fourth and above).

The Newcastle University was selected as the research setting for a number of reasons. There was easy and convenient access to academic staff and students, and the cost of conducting the study was low. The institution was also keen to participate in the action research study, as there was a consensus that the development of a web portal would improve the students' experience. Furthermore, the research was designed to support the University's e-services agenda.

According to the suggestion by prominent authors in the field (Eisenhardt, 1989; Yin, 2003), the feasibility factor could be used as the basis for the selection of the site for an action research study. The practical aspects of the research determined that the organisation should be within reasonable distance (thus minimise travelling cost) and have appropriate managerial and operational support in place, to ensure successful completion of the project. Overall, Newcastle University met these criteria.

Yin (2003) has identified access as one of the factors that needs to be considered when choosing a research organisation. He further added that in order to have flexibility in access, a full co-operation of the organisation should be secured for the duration of the research. Furthermore, accessibility also means a willingness to participate, where this included support both at the executive level for approval and the operational level for participation in research. All of these criteria were satisfied by Newcastle University.

The University has more than 18,000 students and 4,500 staff (Newcastle University, 2008). According to the data collected for the year 2007/08 by the Higher Education Statistics Agency (HESA), the total number of postgraduate students was 4723, of which 1822 were full time and 1759 were international students (Newcastle University, 2009b).

The University has award-winning teaching, learning and research services, with a continual investment of over £10 million per year for provision of the facilities. In addition, the University is investing £200 million in new University's buildings, infrastructure and public spaces (Newcastle University, 2008). These new facilities are anticipated to enhance the University's position as one of the UK's leading teaching and research institutions.

The recent publication of the UK's official survey of research quality, the Research Assessment Exercise (RAE) 2008 has positioned the university as one of the UK's top 20 research institutions. It was ranked 17th in a power table league of research out of 162 universities and colleges in the UK. The league table was published by the Research Fortnight magazine (Macilwain, 2008) which independently analysed and compiled the survey data.

The Humanities and Social Sciences (HASS) Faculty

The HASS faculty is made up of nine academic schools, a dedicated graduate school and the INTO language centre. The academic schools are involved in delivering teaching and conducting research in a number of subject areas. In terms of the research programmes, the academic schools and institutes within HASS offered 10 research degrees including seven at the doctoral levels and three at the master levels. The doctoral research degrees are divided into three types: (a) the professional doctorate (Doctor of Business Administration, Doctor of Applied Educational Psychology, Doctor of Education, and Doctor of Educational Psychology); (b) PhD; and (c) Integrated PhD. Masters research degrees range from Master of Philosophy (MPhil), Master of Literature (MLitt), Master of Research (MRes) and Master of Laws (LLM).

The HASS Graduate School offers a range of provision to support research degree students within the Faculty. The main provision is the Research Training Programme (RTP), which includes sessions on basic research and transferable skills. The RTP has been designed to fulfil the Joint Research Councils' Skills Training Requirements (Research Councils UK, 2001). The modules offered include:

- Managing your PhD;
- Introduction to information skills;
- The nature of enquiry and explanation in the social sciences;
- Qualitative methodology in the social sciences;
- Introduction to quantitative methods;
- Managing personal development;
- Academic writing and self-editing your thesis;
- Fieldwork in Developing Countries;
- Progressing your PhD;
- Research in the wider context;
- Risk management in research projects;
- Introduction to NVIVO (a software package for qualitative data);

- Research ethics in a wider context;
- European Research: possibilities and pitfalls; and
- Final stages of a PhD.

The Graduate School has been using different mechanisms to support these modules, including Blackboard, an e-Portfolio and an online booking system to support the conduct of the research training programme. Each of these systems is described in the following paragraph.

Blackboard is used to disseminate training programme materials as well as other related activities. Announcements concerning all aspects of the research training programme, including changes to locations, times, dates and sessions are posted on Blackboard. In addition, materials relating to the training modules such as lecture notes and hand-outs, details of assessments, timetables, and details of any prior reading required are also available through Blackboard. Furthermore, students are encouraged to participate in discussion relating to the research training through a discussion board available within Blackboard.

In 2004, the University introduced an instrument called the Research Training Portfolio or e-Portfolio to support the continuing professional and career development of postgraduate students. The paper-based portfolio has now been replaced by its electronic version, the e-Portfolio system. The e-Portfolio system was designed to allow researchers to engage, plan, audit, manage and reflect on their research and transferable skills development. Additionally, it will help students to identify areas of strength and those that need more attention. It is expected that by completing the e-Portfolio, students will be able to build on the learning and results that they have achieved. The ongoing record of skills development can contribute towards their personal growth and career planning.

Students are only allowed to book for all modules and sessions in the research training programme through an online booking system - *eBooking*. The system allows students to view a brief description of the modules and session and consequently book appropriate modules. The system records the students' booking information, previous attendance, non-attendance and sessions on waiting list.

The INTO centre is a partnership project between Newcastle University and the INTO national project. The aim of the INTO is to support international students with various English and foundation courses. In addition to the foundation courses, INTO also provides

courses to support current Newcastle University students. These courses include in-sessional courses and English Language Materials Online (ELMO). In-sessional courses provide a range of modules designed to help students who are non-native speakers of English to improve their language and study skills while studying for a degree. On the other hand, ELMO is an innovative, multimedia-based self-study web site, developed to help students expand their skills in English for academic purposes. Both in-sessional modules and ELMO are available free of charge to registered students at Newcastle University.

The Science, Agriculture and Engineering (SAgE) Faculty

The SAgE faculty is made up of ten academic schools and a dedicated Graduate school. Each academic school is responsible for teaching and research in a number of subject areas, whilst the Graduate school handles postgraduate matters including admission, registration and postgraduate training. In addition to taught courses, the academic schools offer various research degree programmes including MPhil, MRes, PhD, Integrated PhD and the Engineering Doctorate (EngD). Both MPhil and MRes are offered at the masters' level and the PhD, Integrated PhD and EngD are offered at the doctoral level.

Similar to HASS, the SAgE Graduate School also provides a postgraduate research training programme. However, this responsibility is shared between the SAgE Graduate School, academic schools and research institutes. The academic schools and institutes mainly address training in research skills and techniques, whilst the Graduate School focuses on providing wider employment-related skills. The research training workshops offered by the Graduate School are categorised to match the skills outcomes of the Joint Research Councils' Skills Training Requirements (Research Councils UK, 2001). They include:

- Creativity and enterprise;
- Research management – PhD development;
- Research management – Library;
- Research management – IT for researchers;
- Personal effectiveness;
- Communication skills;
- Networking and team working;
- Career management; and
- Statistics.

The workshops, activities and events offered through the Research Development Programme carry a credit value that correlates with the time commitment involved. SAgE research

students are expected to gain a certain number of credits throughout their research degree study. Failure to gain adequate credits may cause progress to be judged unsatisfactory.

The SAgE faculty also provide similar mechanisms to HASS Faculty in providing support for the Research Training Programme.

The Faculty of Medical Sciences (FMS)

The Faculty of Medical Sciences comprises a Graduate School, eight institutes and four schools. The major activity within the Faculty involves managing Newcastle Biomedicine, a pioneering centre for medical and healthcare research. The Graduate School offers many higher degree opportunities, including the PhD, Medical Doctorate (MD) and MPhil within various research programmes such as ageing and health, biological sciences, biomedicine and dentistry, cancer research, cell and molecular biosciences, cellular and clinical medicine, dental sciences, education, health and society, human genetics and stem cells, nanoscale science and technology, neuroscience and psychology.

As with both HASS and SAgE, the FMS offers a research training programme known as the Skills Development Programme through the Graduate School to support their research students. The FMS Graduate School uses various systems to support the students in developing their skills. In addition to Blackboard to disseminate materials regarding the development programmes, the FMS uses a dedicated website for this purpose. The materials on the website are available in different forms, ranging from PowerPoint presentations, audio files, PDF files and transcripts of lectures. The FMS also uses an online booking system, where students can book the workshops that they intend to attend electronically. Similar to the HASS and the SAgE faculty, the FMS also uses an e-Portfolio system.

5.1.2 *Description of participants and recruitment process*

The first cycle of action research involved seven PhD students from five different schools or research institutes within the Faculty of Science, Agriculture and Engineering (SAgE). This faculty was chosen because of its Research Programme Director's willingness to assist in providing support in terms of his expertise and research material. Of the seven participants, four were in year 1, one was in year 2 and the rest were in year 3. Only one participant was from Britain, whilst the rest were from the European Union or other countries. All participants

studied full time except for one, who was an exchange student. The demographic of the participants is shown in table 20.

Code	School	Year	Domicile	Mode of Study
P1	Northern Institute for Cancer Research	1	EU	Full time
P2	School of Agriculture	3	UK	Full time
P3	Northern Institute for Cancer Research	1	EU	Exchange student
P4	Marine Science and Technology	1	International	Full time
P5	Marine Science and Technology	3	EU	Full time
P6	School of Civil Engineering	2	International	Full time
P7	School of Chemical Engineering and Advanced Materials	1	International	Full time

Table 20 – The demographic of the first action research cycle participants

The second cycle of action research was carried out to address the problems encountered in the first cycle. Six PhD students from the Newcastle Business schools within the Faculty of HASS were involved. The reasons for choosing HASS faculty were to compare the information requirements collected and to test the suitability of the guiding questions. Of the six participants, three were in year 2; one was in year 1, year 3 and year 5 respectively. All participants were international students, studying full time. The demographic profiles of the participants are shown in table 21.

Code	Year	Domicile	Mode of Study
P1	2	International	Full time
P2	2	International	Full time
P3	1	International	Full time
P4	2	International	Full time
P5	3	International	Full time
P6	5	International	Full time

Table 21 – The demographic profiles of second action research cycle participants

Since the researcher studied within the Faculty of HASS, it was quite easy to recruit participants from that faculty. However, access to UK or EU students was quite difficult. All participants were contacted through e-mail or personal contacts.

The third and fourth action research cycle were based upon a purposeful sampling strategy of selecting homogenous samples to recruit 'information-rich' participants (Patton, 2002). By means of this strategy, participants were recruited to gain an in-depth understanding of the phenomena in question, rather than representing the population (Charmaz, 2002). Because one of the aims of this study was to explore the requirements of research students at each stage of their research, participants were required from three groups: (1) prospective research

students; (2) current research students; and (3) research alumni. However, because of the difficulty in gaining access to prospective students and alumni, only research students currently attending the University were recruited. In order to capture the requirements of all research students, the sample of students recruited should represent: (1) students from various stages of the research process; (2) both international and home students; (3) part time and full-time; (4) three faculties; (5) various research degree programmes; and (6) females and males.

To recruit the participants, the researcher first approached each of the three faculties' research programme directors' secretaries. The secretaries helped send out an email to all research students. The email explained the purpose of the focus group, a brief description of the prototype portal, together with a web link, the dates and times of the focus group sessions and the researcher's contact email.

The response to the call for participants notice was extremely poor. Only three students from the HASS faculty, three students from the SAgE faculty and none from the Medical faculty replied. Of the three students from HASS, only one came to the focus group. This also happened to the three students from SAgE, with only one coming to the focus group. Meanwhile, an alternative approach was adopted to look for participants, which was to contact research students through an email posted by the schools' Postgraduate Secretary. This method yielded no responses. The researcher also asked her colleagues to forward the same email to their friends from other schools; however, this method also resulted in no response. Additionally, the researcher made use of personal contacts through snowball sampling. Finally, 15 students from HASS, seven students from SAgE and four students from the Faculty of Medical Sciences agreed to attend one of the focus group sessions. Altogether, 26 students participated in six focus group discussions. Table 22 below shows the details of each focus group.

Name	Faculty	Location	Number of Participants
Group 1	HASS	Computer cluster	5, one of them had to leave early
Group 2	HASS	Computer cluster	5
Group 3	HASS	Computer cluster	5
Group 4	SAgE	Computer cluster	3
Group 5	SAgE	Computer cluster	4
Group 6	FMS	Home	4

Table 22 – Focus groups

All of the students were full time; therefore part time students were not represented in the

focus groups. The complete attributes of the participants' profiles is shown in table 23.

Attributes		Number of Participants (%) n = 26
Faculty	HASS	15 (58%)
	SAgE	7 (27%)
	FMS	4 (15%)
Gender	Male	9 (35%)
	Female	17 (65%)
Mode of study	Full-time	26 (100%)
	Part-time	0 (0%)
Origin	Overseas	25 (96%)
	Home	1 (4%)
Programme	PhD	25 (96%)
	DBA	1 (4%)
Status	Year 1	7 (27%)
	Year 2	7 (27%)
	Year 3	8 (31%)
	Year 4	4 (15%)

Table 23 – Profile of focus group participants

In order to overcome the non-representation of part-time students, another round of recruitment was conducted. This time, students undertaking the DBA degree were approached. The DBA programme includes several workshops throughout the year. As one of the workshops was conducted during the data collection period, the researcher approached the DBA Workshop Coordinator to ask for DBA students' participation. After the necessary arrangements were made between the researcher and the DBA coordinator, two sessions of three and two-participant focus group were conducted. Of the five DBA participants, four were part-time overseas students. Table 24 below shows the profile of the DBA participants.

Attributes		Number of Participants (%) n = 5
Gender	Male	4 (80%)
	Female	1 (20%)
Mode of study	Full-time	1 (20%)
	Part-time	4 (80%)
Status	Year 1	1 (20%)
	Year 2	3 (60%)
	Year 3	1 (20%)

Table 24 – DBA students' profile

The difficulties in finding particularly local participants and from the Faculty of Medical Sciences, led the researcher to consider interviewing individuals. Through the researcher's personal contacts three more participants from the Faculty of Medical Sciences and one from the HASS faculty participated in the interviews. Of the three full time students from the Faculty of Medical Sciences, two were in their first year, with one being female and - one a home student. The participant from HASS was a local student in her first year of undertaking

a full time PhD degree. Overall, 31 students participated in the focus group and four students participated in an interview. Table 25 shows a summary of the participants' profiles.

Attributes		Number of Participants (%) n = 35
Faculty	HASS	21 (60%)
	SAgE	7 (20%)
	FMS	7 (20%)
Gender	Male	14 (35%)
	Female	21 (65%)
Mode of study	Full-time	31 (89%)
	Part-time	4 (11%)
Origin	Overseas (including EU)	32 (91%)
	Home	3 (9%)
Programme	PhD	30 (86%)
	DBA	5 (14%)
Status	Year 1	10 (29%)
	Year 2	11 (31%)
	Year 3	8 (23%)
	Year 4	5 (14%)

Table 25 – Profiles of all participants

5.1.3 *Reflection on the recruitment process*

Gaining access into the research setting has been reported as a difficult task facing qualitative researchers (Patton, 2002). This task becomes even more difficult if the research focuses on a sensitive topic. In particular, if it involves access to the financial data and organisation performance. Even though this study does not requires the researcher to access sensitive data, gaining access to one of the highly prestigious UK academic institutions is still considered as a challenging task. However, in this case, the researcher had a privilege as this action research project was aligned with the case University e-services project. Although there is no explicit agreement between the researcher and the top managements of the case University about the access, the permission to do an action research study was implicitly granted after a meeting to discuss the contribution of this research in the e-services project. Therefore, it can be established that gaining access to the case University was not as difficult as the researcher as anticipated. However, it was quite challenging to recruit research students studying at the case University to participate in this research. In retrospect, the researcher believes there is one possible reason for this. In general, research students value their time very highly as they may have other commitments that they need to attend to besides participating in this action research study. This is especially true for mature students who have family or work commitments. Agreeing to participate in the research would mean that they need to spend some of their valuable time in interviews that otherwise could be spent on their study. Perhaps they will be more willing to participate if they are invited to answer questionnaires that take less time than an interview.

Despite the difficulty in gaining access to research students, this study has successfully recruited 48 participants which produced rich information and data. This consequently has proved helpful in addressing the research questions. Of various sampling techniques used in this study, the researcher found that the snowball sampling proved most successful in recruiting research students that resulted in 28 participants. Snowball sampling is typically used to obtain participants that are hard to reach or hidden population such as homeless people, prostitutes and drug addicts (Faugier and Sargeant, 1997). Furthermore, Hendricks and Blanken (1992) argues that it is also suitable in the event of participants are few in number or where some degree of trust is required to initiate contact. Even though this study does not involves hidden population or hard to reach participants, the evidence shows that snowball sampling is equally effective in recruiting research students as recruiting 'hidden population'. The researcher believes that this is because research students are more willing to spare their valuable time if they trust their friend's recommendation.

The guiding principle of sampling in qualitative research is one of convenience (Lincoln and Guba, 1985). This principle suggests that a researcher should selects those persons that are easily available that will allow the researcher to collect data about them. In this respect, the snowball sampling offers both practical advantages and convenience in recruiting participants.

5.1.4 *Reflection on researcher's roles and responsibilities*

In addition to the action research cycles, it is also important to indicate the people involved in this project and their relevant responsibilities in order to show the extent to which the researcher was involved in the development of the portal. The development involved two separate tasks – 1) common portal framework and 2) a prototype portal. The University web team was responsible to develop the common portal framework while the researcher was responsible to develop the prototype portal. At the beginning of the development, there were three people responsible for the development of the common portal framework. During the development, for personal reasons, one member left the University. Thus, the development team was left with two people. However, only one of the web team remained to work alongside/collaboratively with the researcher until the end of the project. The researcher was quite worried when the first member left. This is because she is afraid that it might cause delays in the completion of the framework that could directly affect her research. However, it

turned out that a one-person team was able to develop the common portal framework. The researcher was grateful that the research was completed successfully despite the withdrawal of the two members of the web team.

The researcher has a dual-role in this action research study. In addition to being an action researcher, she acted as a designer for the web portal. This role requires her to be an intermediary between the students and the technical team. The researcher felt that this role has some advantages. Since she was a research student herself, she understood the needs of the people like her and could communicate these needs to the technical team. In the course of the portal development, the researcher has improved her programming and social skills. She learnt how to develop web applications using software development product such as Macromedia Dreamweaver and Macromedia Flash. She also learnt JavaScript (Flanagan, 2001), a scripting language suitable for web application development. In terms of social skills, the researcher believes that she has improved her communication and negotiation skills.

The stakeholders in e-services included several top managers from several departments within the University. However, they were not directly involved in the development of the framework or the prototype portal. Instead, their consent and comments were sought throughout the development process. The stakeholders include the Vice Chancellor, Marketing Manager, Librarians, Web Development Officers, the graduate schools and Teaching and Learning Officers.

5.2 Implementation of Research Method

The previous section discussed the context of this research, in particular the research setting, participants and the roles and responsibilities of the people involved. This section is concerned with the process of its implementation. As outlined in Chapter 4, the characteristics of action research suggested that the method was well aligned with the objectives of this research and was therefore a suitable research method. This section identifies action research limitations and provides an overview of action research cycles.

5.2.1 *Management of action research limitations*

In choosing to adopt the ‘involved researcher’ strategy in action research, the researcher was

able to gain in-depth and valuable information from the research students. Yet the problem of researcher bias became unavoidable and required delicate management. As explained in section 5.1.3, the researcher was a research student studying for a PhD. Thus, the researcher had her own views and perceptions of research learning as well as requirements for online support. Furthermore, having decided to be the developer of the prototype portal, it gave her the means to establish a close relationship with students, but at the same time the researcher formed her own understanding of blended research learning and technologies. This might have endangered the value of the research outcomes. However, the researcher believes that good access to students and a first-hand understanding of the context outweighed the issue of researcher bias. Furthermore, the use of multiple data sources, verbatim transcripts of focus groups and interviews and the process of triangulation helped to minimise the problem of subjectivity and bias.

As discussed in Chapter 4, action research, like any other qualitative methods, suffers from the problem of statistical generalisation. Nevertheless, Lincoln and Guba (1985) pointed out that transferability of findings could be achieved by providing the reader with a rich, thick description of the time, place, context and culture in which the particular study findings were based. This study facilitates the transferability of its findings to others through the following: 1) a detailed account of all significant situations; 2) an outline of the aim, theory and method used; and 3) by providing a comprehensive account of the action research cycles.

Another limitation of action research is concerned with the differentiation between consultancy and research. This research has taken the following steps in preventing a consultancy type of project: 1) documentation relating to events and data collection were recorded, transcribed, analysed and presented to the participants; 2) the theoretical rationalisation was based on theories of learning, which were used in order to understand the theoretical effects in practice; 3) the action research was conducted in four cycles instead of linear style; and 4) in terms of deadlines, there were none except for the PhD completion period. The project did not seek to gain any monetary rewards.

5.2.2 *Summary of action research cycles*

This research was conducted in four action research cycles. A summary of all the activities is shown in table 26. The first row of the table presents the description of the participants. The

second row of the table outlines the version of the prototype portal used and the last row provides information on the data collection techniques employed. Some of participants in cycle two were also involved in the cycle three of the action research.

	Cycle 1 (Feb 2007)	**Cycle 2 (Aug 2007)**	**Cycle 3 (Feb – Mar 2008)**	**Cycle 4 (Jul – Sept 2008)**
Participants :				
Faculty	SAgE	HASS	HASS, SAgE, FMS	HASS, FMS, DBA
Year of study	1, 2, 3	1, 2, 3, 5	1, 2, 3, 6	1, 2, 3
Domicile	UK, EU, International	International	International + UK	International, UK, EU
Mode of study	Full time	Full time	Full time	Full and Part time
Prototype version	Static web site	Version 1 Postgraduate portal	Version 2 Postgraduate Portal	Final version Postgraduate Portal
Data collection techniques	Focus group + observation	Focus group + observation	Focus group + observation	Focus group + observation + interview

Table 26 – A summary of the action research cycles

The next section provides an overview of the data collection activities involved throughout the four action research cycles. Emphasis is placed on the individual processes to provide the reader with the richness of the action research experience.

5.2.3 *Data collection strategy*

In the previous sections, this thesis has introduced the setting of this research and laid out the management of action research limitations and the structure of the action research cycles. The purpose of this section is to describe the processes of data collection that were employed in this research namely observations, focus groups and interviews.

In order to elicit the requirements of prospective research students, participants were coached to think retrospectively to when they were applying for a research degree. Accordingly, participants were also coached to think about the information that they would have required in the previous and subsequent stages of their study. For example, participants who were in their first year of study were asked to think about the information that they were looking for before applying and expected to have had in second, third and final year as well as after leaving the University. In order to address any potential differences between what people anticipate they

need and want and what they actually needed and wanted, participants were asked to discuss their experience of the previous stage of their research study. For example, participants who were in their first year were asked to discuss what they actually did when they were applying to do their research degree. This experience was compared with the documented information need and requirements gathered through the literature review and various research degree documents and websites.

Observation

The observations made in this research were based on the researcher's perception of the interactions of students with the prototype research portal being developed. There were no specific structures in observing the participants, but any events that were perceived as 'unusual' were given particular attention. However, to avoid the risk of over reliance on impressions, the research questions were used as guidance in collecting observation data. Since all participants signed consent forms which allowed their comments to be used for this research, covert observation was judged to be acceptable. Furthermore, covert observation reduced the observer effect.

The observations were recorded using field notes. Lofland and Lofland (1999) explained the mechanism for taking field notes. They argued that field notes are generally written down from memory at the end of the interview. Therefore, in this study the notes were written up straight after the focus groups or interviews. The notes included a description of how participants reacted (including their facial expressions) towards the web portal as well as how they browsed each of the portal's areas when they were asked to experiment with the system. The field note information provided only hard evidence of interview background; it may not have offered rich raw data for constructing the user requirements, however it was indeed a sufficient resource by which to explain the possible attitudes and behaviours of research students. Therefore, the field notes were not directly utilised in the data analysis, but in the theme discussion, as reported in Chapter 6.

Focus Group

This section is organised into three sections. The first section discusses the procedures used to conduct focus groups in the first action research cycle, while the second section discusses the procedure used to conduct focus groups in the second action research cycle, and the third

section discusses the procedure used to conduct focus groups in the third and fourth action research cycles.

Cycle One

The focus group was held within the case university. Once everyone was assembled, consent forms were distributed and the study's purpose was explained. Prior to the discussion day, an email with the consent form attached was sent to all participants asking them to fill-in the form and send it back electronically. Three sent it electronically and the rest return it during the focus group. At the meeting, all participants were asked verbally about the use of both digital audio and video recordings. Since no participants expressed any particular concern with the discussion being recorded, they were asked to sign their consent forms together with the researcher. The researcher guided the discussion, while a second person operated audio and video recorders and took a note. The session lasted about 70 to 80 minutes. Participants were offered refreshments at the end of the session.

The guiding questions (see Appendix B) were developed based on Krueger's (2000) questioning route guidelines. Following the guiding questions, the focus group session began with an opening question about the participant, then an introductory question about the information needs prior to coming to the University was posed, followed by questions about the information needs while they were at the University, and finally questions about the information needs after leaving the university. At the end of the session, the researcher demonstrated the portal (see Appendix K for static portal's screenshots) to the participants and asked them to comment and compare the information provided within the portal with the information that they thought they would need. However, because of time constraints, the demonstration was cut short. Consequently, not many comments on the portal were generated in this session.

Cycle Two

The focus group in action research cycle two was held in a computer cluster. Once everyone was assembled, consent forms were distributed and the study's purpose was explained. All the participants were asked to sign their consent forms, together with the researcher. Only digital voice recorders were used to capture the discussion as the first action research cycle found

that using a video recorder did not assist in the transcription or the analysis of the data. In order to facilitate the group discussion, each participant was given a link to the web portal and asked to explore it. Prior to this, a brief introduction to the portal and its content was presented.

The discussion started with every participant introducing him/her self. Then an appropriate discussion continued after the researcher demonstrated a section of the portal (see Appendix L for the portal's screenshots). Demonstration and discussion were undertaken one after another until the researcher had demonstrated the final section of the portal. The participants were also allowed to browse the links within the portal before each discussion took place. It was found that by giving the participants the opportunity to browse the portal, clearer statements of need were discovered.

The discussion lasted approximately an hour and a half. Based on both action research cycles, it was decided that that a two-hour session would be ample to finish the focus group's guiding questions. This is because the demonstration of the portal also took time, since some participants needed clarification on some of the links or functions of the portal.

The guiding questions for the second action research focus group may be found in Appendix C. The guide contains topic questions regarding users' information need as well as evaluation questions relating to the e-learning portal.

Cycle Three and Four

As practiced in the previous cycles, the consent forms were sent via e-mail before the discussion took place. This was undertaken to ensure that the participants could read and resolve any issues that might have occurred. However, the procedure was not applied to the DBA participants, because the researcher did not have the participants' contact details in advance. With respect to the DBA participants, the consent forms were handed out at the beginning of the discussion.

Besides the consent form, the email also contained a personal information sheet attachment (see Appendix D). The purpose of the information sheet was to collect the participants' demographic data. The participants were asked to bring the information sheet to the

discussion day. Necessary arrangements were taken for participants who forgot their information sheet, such as allowing them to fill in the form at the beginning of the discussion.

The discussion proceeded in two steps. The first step began with the researcher welcoming the participants and expressing her gratitude for their help. This was followed with an explanation of the purposes of the focus group and setting some ground rules, such as everyone's view would be treated with respect and anonymously. The researcher also confirmed with the participants that they agreed with the discussion being recorded and asked the participants to sign the consent forms together with the researcher. All participants accepted the condition except one DBA participant. However, after further explanation, he allowed the researcher to record the discussion.

The participants were then asked to introduce themselves briefly. Following this, a list of research tasks was given to the participants. Based on the research tasks, the participants were instructed to discuss and write their information requirements by working in pairs. After about 10 minutes, the group was merged again, and a discussion of the information requirements took place in a group, with the researcher as the facilitator.

The second step involved the researcher demonstrating the portal by using the walkthrough technique. The researcher explained each of the functions of the portal, and demonstrated how the customisation worked and how users could personalise the portal. After the demonstration, the participants were asked to log-in individually and experiment with the portal as well as personalised it.

The participants were then brought back together, and asked to comment on the features of the portal. These included customisation features such as: the presentation of news and events and research training programme modules provided by the School and Faculty; the ordering of tabs based on year of study; and the number of RSS feeds and bookmark boxes. The participants were also asked to comment on personalisation features. These included the ability of users to add their favourite RSS feeds as well as favourite websites within a bookmark facility. Furthermore, the participants were also asked to suggest additional features that they would need in a postgraduate research portal.

Following this, the participants were asked to explore each tab, starting with the 'Applicant'

tab page. To assist the discussion on information needs for the application stage, the participants were asked to take a retrospective approach by thinking back to the time when they were applying. Feedback on the most useful or insignificant links, as well as additional information resources was sought from the participants. In addition, to facilitating the discussion, the participants were asked to describe the process of their application to the research study and the information that they were looking for. The same process of eliciting feedback was repeated for the rest of the portal tabs including 'Induction', 'Getting on', 'Developing', 'Completing' and 'Alumni'. When necessary, the participants were coached to think ahead about the information that they would expect to have had in the subsequent stages of their research, and compare it to the information resources presented by the portal. Finally, the participants were given a chance to comment on any issues accidentally left out by the researchers. The participants were offered some light lunch at the end of the sessions.

The number of participants in the groups varied between three and five, with an average of four. The sessions lasted approximately 90 to 125 minutes. All focus groups discussions were conducted at a computer cluster, as this location was found to be very conducive to generate discussion on needs statements (Krueger and Casey, 2000). All focus group discussions were conducted in English, except for one SAgE group which was mainly discussed in Malay and occasionally used some English words or phrases. A list of pre-determined, open-ended questions was used to ensure the same questions would be asked in groups (see Appendix V).

Although all questions during the focus group discussions were asked according to the focus group protocol, the researcher also facilitated spontaneity and free flow of thoughts which were generated through the interactive group dynamics in an attempt to generate as many ideas and feedback as possible. In practice, the topic questions acted as guidance; in all cases, there were discussions on some emergent issues that had not been previously planned. Following these emergent issues, the researcher sometimes had to come back to previous participants to ask for more explanation. The medium used was either email or face to face informal conversation. In parallel, there were issues that were not discussed due to non-occurrence in the cases. During the data collection, the focus group questions guide was updated to include questions regarding emerging issues raised by previous focus group discussions. The issues that were explored in more details included, but were not limited to the requirement for University research facilities, specifically scientific or laboratory equipment, project management and document sharing tools.

Interview

Following the same procedure as in the focus groups, all interviewees were sent the consent form as well as the personal information sheet (See Appendix D) via e-mail a few days before the interview. The interviewees were asked to read and raise any issues that concerned them especially regarding the research consent form.

At the beginning of each interview, the researcher expressed her gratitude for the interviewees' help. Following this, participants were briefed on the purpose of the study, and some ground rules were set based on the research consent form. The participants then signed the consent form, together with the researcher. Next, they were asked to return or fill out the personal information sheet.

The steps followed in the interviews were slightly different from the focus group. Since it was an individual interview, the first step followed in the focus group was left out. A second step was then followed, whereby the researcher started the session by demonstrating the portal. This included explaining the purpose of the portal as well as its functionality. Following this, the interviewees were asked to log in to the portal and personalise it according to their requirements.

Interviewees were first asked to explore the portal's customisation and personalisation features. After the participants had completed experimenting with each of the personalisation and customisation features, their reactions were elicited. The views sought included the interviewee's perception towards each feature and her/his recommendations for any other features deemed necessary to support their research tasks.

Then, the researcher started to demonstrate the tab corresponding to the interviewee's stage of study. This approach was taken to show the interviewee that the portal is developed to display the most relevant information to support their research tasks at that stage. For example, if the interviewee was in their third year of study, the tab demonstrated was the 'Completing' stage. Next, the interviewee was instructed to explore all the links within that tab. Questions and feedback regarding the content of the 'Completing' tab were asked. Subsequently, the next subsequent tabs in the order were explored, and feedback was sought from the interviewee. This process was followed until each of the tabs was covered. All interviews ended with the same questions, as in the focus groups. At the end of the session, the researcher thanked the

interviewees and provided some light lunch as a token of her appreciation for their help.

The length of the interviews varied between 60 and 90 minutes with an average of 80 minutes, and all the interviews were digitally audio-recorded. The venue for the all interview sessions were the same as for the focus groups. The topic guide followed in the interviews is available in Appendix F.

5.2.4 *Data analysis*

The analyses were performed simultaneously with the collection of data and involved both within-case analysis and cross-case analysis (Miles and Huberman, 1994; Patton, 2002). Within-case analysis seeks to understand each case as "a unique, holistic entity" (Patton, 2002, p. 387) and to draw "descriptive conclusion" (Miles and Huberman, 1994, p. 90). Cross-case analysis was performed to "build abstractions across cases" (Meriam, 1998, p. 195), to seek explanations (Miles and Huberman, 1994) and to reveal different perspectives of the central phenomena (Patton, 2002). The analyses of the focus group and interview transcripts proceeded in five steps. The analyses were an ongoing and iterative process until the researcher was fairly confident and satisfied with the findings of the research.

Step 1 – Data Preparation and Management

All of the group and individual interviews were recorded using several digital voice recorders. The researcher listened to the recordings several times either on the day following the interview session (when possible) or on a later day and transcribed them verbatim. The verbatim transcription helped the researcher to conduct a more thorough examination of the discussion and follow leads that were previously thought trivial. Additionally, by transcribing the interviews herself the researcher was able to immerse herself in each of the transcripts, thus, allowing the identification of themes more easily (Jennifer Mason, 2002). All the transcripts were directly typed on to Microsoft Word® documents and were labelled according to the interviewee or focus group's code, date, time and length. As a validity building process, interviewees were invited to comment on the transcripts. The individual interview transcripts were sent via email to the individuals for member checking. However, for the focus group transcripts, the researcher asked several colleagues to confirm phrases or words that she had difficulty in understanding. The validated transcripts were imported into the NVivo programme to form a database for analysis. NVivo is a qualitative data analysis

software package which allows codes to be attached to data, and retrieved and sorted in a variety of ways (Richards, 1999).

The transcript portions that were in Malay were translated into English by the researcher during the early stage of the data analysis as well as during the writing up of the thesis. Following the suggestions of Atkinson (Atkinson, 1998, p. 55-56) and Rubin and Rubin (1995, p. 271-273) on editing transcripts, minor editing was performed on the quotes selected to be included in the thesis. The process of editing included the following aspects: using standard spelling and grammar; leaving out unnecessary words used as fillers; false starts; backing-and-filling; and tag questions such as 'you know'. Moreover, words or phrases (indicated by putting it in square brackets) were added for clarity in the case of incomplete sentences or unclear meaning after being decontextualized from the completed transcripts.

The quotes selected to be included in the thesis were documented in a bracket as the following: (a) the abbreviation of faculty or programme (except for action research cycles one and two where participants involved in one study came from one faculty, thus only interviewee code was recorded); (b) the interviewee code; (c) a hyphen; and (d) focus group or interview code. For example, (HASS1_Group2) means that the quote is extracted from participant 1 who studied in the Faculty of HASS, in the transcripts of the second focus group session.

Step 2 – Familiarisation

The second stage involved immersion in the data. The researcher read the transcripts numerous times to get a sense of the data. In addition, notes were made and diagrams were drawn.

Step 3 – Themes and Inductive Process

This stage involved coding the data. As discussed earlier, NVivo was used to help manage the data. The data were first coded as 'free nodes', which was the simplest way to indicate a group of materials sharing a basic meaning, idea or concept.

Step 4 – Elaboration

Themes were explored in more detail at this stage. For each theme, key ideas were identified, and similarities or differences were highlighted. In addition, categories that were more general

were added as appropriate to group similar themes together. General patterns, with respect to relative importance of categories, were also identified using content analysis. Relationships were also identified at this stage of analysis.

Step 5 – Interpretation

The final step involved bringing together all the categories. During this step, meanings were attached to relationships or connections between themes.

5.2.5 *Adherence to action research quality criteria*

In this section, the thesis discusses how the action research conducted adhered to the five quality issues as outlined by Reason and Bradbury (2001). Five quality criteria include relational praxis, reflexive-practical outcome, many ways of knowing, significant work and new and enduring consequences/infrastructure. In terms of the relational praxis, there are some issues related to genuine participation. The researcher and the web team collaborated in the development of the portal. The web team was responsible for developing the common portal framework which was consequently being used by the researcher to populate the web portal. In this regard, both parties brought different knowledge and motivation to the action research. With regard to the knowledge the web team shared their technical skills while the researcher shared her knowledge about the problem situation – needs of research students. The researcher's ultimate motivation from the action was to get her PhD, while the web team's motivation was to develop a portal framework that could be useful for the Universities' web application. Even though their motivations differed, but they complement each others. The web team need the feedback for their common portal framework while the researcher needs to experiment with the common framework to test her design ideas.

In terms of reflexive practical outcome, this thesis had a tangible outcome – the prototype web portal. According to Kemmis (2001), there are three types of action research outcomes: technical – functional improvement; practical – personal lessons from the action research; emancipatory – about empowerment. The thesis had a technical focus – designing and developing a web portal support for postgraduate research students. Thus, the technical outcome is the web portal design which was being validated through the action research cycles. In terms of the practical knowledge, the researcher believes that she has become aware of the resources available to support her research by participating in the action research. She also has become aware of the available information system research methodologies and their

use in practice. In terms of the emancipatory outcome, based on the analysis of the data, the researcher could assume that by participating in the action research, the research students has gain knowledge in terms of the availability of online information and resources support.

The research produces qualitative data based on focus group, interview, observations and reflexive accounts of the process of prototyping. Experiential knowledge was gained through the use of prototyping in the development of the portal and through collaboration with the web team and the research students.

The researcher believes that this study is a significant work. The study sheds some lights on the use of prototyping in the design of a web-based system and opens up opportunities for research students to explore online resources that could support them throughout the stages of their life. However, compared to Reason and Bradbury (2001, p. 449) interpretation of significant work as "that work is inspiring. It helps me live a better life", this study does not focus in that social direction.

One aspect of the new enduring consequences could be reflected upon the interview data. For example, some research students informed that they continue to use the prototype web portal (until the University remove it from their server) even after the action research ended. The usage of the web portal infers that it was useful and supported the needs of the research students. Through reflecting on the experience of conducting the action research, the researcher is motivated to apply action research to improve her teaching practices.

5.3 Summary

This chapter has established the context in which this study took place and provided readers with detail information about the organisational setting. Section one presented the overview of the research setting. Section two discussed the implementation of the research method and strategies adopted in addressing the limitations of action research. Section three set out the strategies and procedures for each technique adopted in the data collection phase. Finally, the chapter concluded with the discussion of how the data gathered was analysed and synthesised.

Chapter 6. Results and Discussion

The previous chapter presented the implementation of the research methods. Explanation of the research setting, the participants and the roles and responsibilities of the people involved were given from an interpretive standpoint. Chapter 5 also discussed the structure of the research methods, the data collection strategy and data analysis undertaken in this research. This chapter presents an action research intervention within the Newcastle University in order to empirically explore the problems of providing effective information and resources support to postgraduate research students.

6.1 First Action Research Cycle

This action research cycle involves the development of an initial prototype – the static web portal. As discussed in the Introduction chapter, the development of the portal originated from a grant by one of the supervisors. However, the work on the initial portal started before the supervisor secured the grant. Therefore, at this stage, the researcher was tasked to develop the web portal without the involvement of the University's web development team. The development of the initial prototype portal started around October 2005. Following the Information System prototyping approach, the researcher began by analysing the current provision for supporting postgraduate research students at the case university. This includes a thorough examination of the University's documents relating to higher research degrees such as the research students' and supervisors' handbooks, the research training handbook, the code of practice and the library's research information webpage. Following this the researcher conducted a review of the literature on issues within research degrees, particularly the PhD research and web-based technologies. Based on the literature review and documents consulted, a general model of the key stages of the research degree process and associated information resources were identified. These activities became the basis for designing and developing a prototype web portal for the research.

The prototype was subjected to numerous iterative cycles of build and test before it was ready for the intervention stage. However, only iterations considered critical were included in this narrative. This includes consultation with the case University's library liaison officers. The purpose of the meetings were to consult their views on the web portal as well as to learn from their experience of developing a library webpage dedicated to providing information to support research students. Furthermore, the researcher also consulted the director of the

research training program from the Faculty of SAgE graduate school. Besides providing his views on the web portal, the director was really keen to be involved in the project and offered his help in providing relevant content for the portal. The researcher updated the web portal based on feedback from both the library liaison officers and the director.

6.1.1 *Overview of the intervention*

The aim of this action research cycle was to explore the possibilities of introducing a centralised online information and resources support to postgraduate research students. The researcher with the advice of her supervisor decided to conduct pilot focus group to obtain feedback from the research students toward the static web portal.

Prior to conducting focus groups, the prototype portal was subjected to user testing to ensure that all the links and navigation within the portal worked. The testing was done by two research students from the Faculty of HASS. Both were given a testing template (Appendix A) that required them to make comments on any broken links or failed back buttons. After the necessary updates to the portal, the researcher prepared for the focus group discussions.

One focus group discussion was conducted amongst a broadly representative sample of research students from the faculty of SAgE. They constituted a broadly representative sample in terms of gender and domicile, as well as a mix of year groups. The discussion focussed on information needs to support a before, during and after research study and a demonstration of the static website, which is being developed to assist in eliciting user requirements. Table 27 summarises the key actors in the first action research cycle.

Key Actors	Task
The researcher	Design and develop the initial web portal
A senior lecturer in Operation Management (he was later promoted to a professorial position)	The researcher's supervisor and team member of the e-services project
A Director of the SAgE Research Training Programme	Represented the SAgE graduate school. Who is keen in the web portal development and offered help to provide content for the portal. Also provided his feedback on the initial portal.
Library liaison officers	Provided feedback on the web portal and exchange their experience of developing library web pages
Around 7 research students from the faculty of HASS.	These students would be the beneficiaries of the system. Their views were sought to improve the web portal.

Table 27 – Key actors in Action Research Cycle 1

6.1.2 *Reflection from the action*

The first cycle revealed that the venue chosen for the focus group was not suitable. Since a demonstration of the prototype portal was part of the focus group procedure, suitable computing facilities were required. However, the venue did not have these facilities. Hence, one of the staff technicians was asked to set up a lap top and necessary internet connection. Even though the researcher had already allocated time to set up the computing equipment, difficulties occurred and it took more time than expected. Thus, the discussion time was cut short, and consequently the researcher's focus was interrupted. Because of the insufficiency of time, only half of the guiding questions were covered in the discussion.

The first cycle also revealed that there was a pitfall in the focus group procedure. Instead of demonstrating the portal at the beginning of each discussion, the researcher demonstrated it at the end. Having done this, the researcher found that greater focus discussion could have been achieved if the portal was shown to the participants at the beginning. This was because the portal was found to stimulate the participants' ideas as to what information needs and user requirements they required, and therefore, more focus discussion would be achieved. In addition, the participants did not have a chance to explore the portal themselves. The researcher only demonstrated the portal to them. It is believed that by experimenting (browsing) through the portal themselves, more fruitful discussion would be achieved.

Overall, the guiding questions proved to be successful in eliciting research students' information needs. However, it did not deal with eliciting users' requirements towards a postgraduate research portal. Furthermore, the time constraint, as explained in the preceding section, limited the period for exploring the portal features required by research students.

During the first action research cycle, the researcher found an appropriate way to conduct the focus groups, and also developed moderating skills. She became more capable of handling dominant participants, and was more comfortable with probing and prompting the participants by using their words in a less mechanical way. In addition, she learned that by using participants' first names, a more relaxed and informal atmosphere could be achieved, thus encouraging more discussion. Although these points seemed trivial, they were crucial to successful focus group discussions (Krueger and Casey, 2000).

In terms of the feedback on the postgraduate research portal, the requirements centred on the types of information needed before, during and after the research study. Analysis of the focus group discussions also found that academic staff profiles provided critical information for prospective research students (see Appendix G).

6.2 Second Action Research Cycle

So far, this chapter has outlined and discussed the first action research cycle which was conducted mainly to elicit information requirements of research students toward a postgraduate portal and experimenting with focus group and moderating techniques. This section now discusses the second action research cycle that was conducted to address the problems encountered in the first action research cycle.

As this action research works on improving the prototype portal through out the action research cycles, it is quite difficult to point the exact time the cycle two started. However, the distinction between cycles was characterised by the version of the prototype portal. In cycle two, a more interactive version of the web portal is use. There might be some overlap of times between the cycles. For example, action research cycle two started before the action research cycle one's intervention was carried out. This is because of the need of the web portal's content to comply with the case university's identity – this is discussed later. Meanwhile, there is a need to introduce the web portal and obtain research students initial feedback on the static web portal while waiting for the common framework to be ready.

Reflections upon the first cycle of action research indicate two sets of concerns that need to be addressed in the second action research cycle. The first concern is related to the conduct of the focus group discussions, whilst the second concern is related to development of the prototype portal. As discussed in Section 6.1.2, issues related to the conduct of the focus group included the fact that the venue for the focus group discussion in the first action research cycle was not appropriate. The procedure as well as the guiding questions for the focus group needed to be improved. Concerns related to the portal development, including the content (information resources) and functions to be incorporated into the postgraduate research portal.

This stage included developing plans to address the problems identified at the diagnosis stage.

The first plan considered improving the research portal based upon users' feedback, while the second plan aimed to improve the conduct of the focus group. The content of the portal was updated based upon information on requirements collected in the first action research cycle. As discussed in Section 6.1.2, academic staff profiles were found to be critical at the application stage. The University has a system called CAMA that captures profiles of all their staff. To avoid reinventing the wheel, it was decided that data about academic staff profiles could be generated by accessing this system.

In terms of improving on the focus group discussion, several locations, including computer labs and the Data-stream room, were considered as appropriate venues for the focus groups. The procedure and guiding questions were also improved, based upon the evaluation of the first cycle.

6.2.1 *Overview of the intervention*

As discussed in the preceding section, the web portal needed to incorporate content related to academic staff profiles. In devising a mechanism to populate academic staff profiles, the researcher started by developing a search function. However, the researcher faced some difficulties in developing the function. After consulting with the case university computing staff, a different problem was discovered. It was found that the content of the static web portal did not comply with the University's Corporate Visual Identity (CVI). The term CVI is used to describe "a system which governs the use of the name and logos of the university" (Newcastle University, 2009a). Several meetings were held with computing staff to discuss issues and devise solutions. As the portal development project was a part of a University wide e-services project, it was proposed that the e-services project would benefit from the development of a common technical framework. The development of the common framework solved the CVI problem, but the search function problem remained unsolved. As searching academic staff profiles involve issues of confidentiality, it was later agreed that the search function should be removed from the prototype portal.

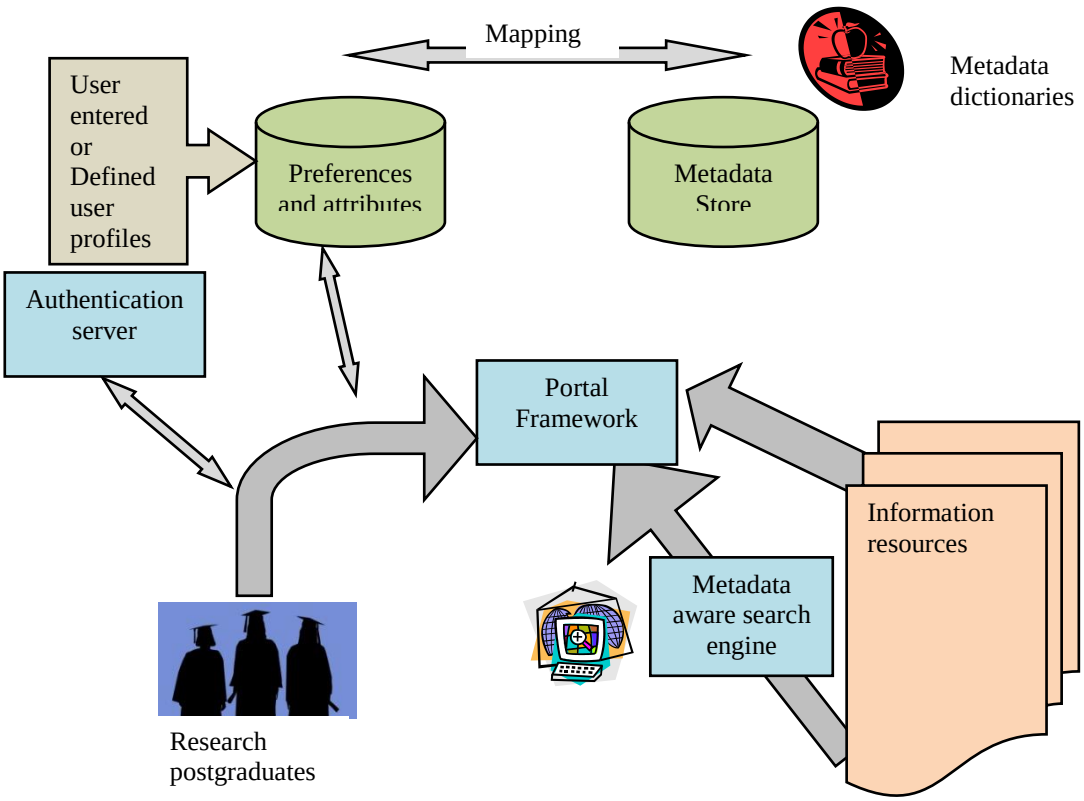


Figure 19 - The portal framework

After several discussions relating to the requirements of the technical portal framework, the University computing staff agreed to use their expertise to develop the common portal framework. Accordingly, the researcher was responsible for identifying the requirements of the portal, which included both the portal's content, based on the research students' information requirements and the portal's functionalities and features. After this, by using the framework developed (shown in figure 19), the researcher used Macromedia Dreamweaver software to develop the prototype web portal. Several more meetings were held with stakeholders from the e-services project to discuss the necessary components of the portal's framework.

The development of both the portal and its framework were incremental and iterative processes. Since the development of the framework was the responsibility of the computing staff, the following action research cycles only describe the steps taken by the researcher to develop, test and evaluate the prototype portal. However, the discussions which occurred during regular contact between the researcher and the computing staff were included in the discussion.

After the e-services stakeholders agreed on the components of the portal's framework, the researcher met with the computing staff to discuss a detailed plan of how to proceed with the development. The plan identified how the researcher would collaborate with the computing staff, and defined the tasks of both the computing staff and the researcher.

Two months after the meeting, the computing staff delivered the first phase of the completed framework. The framework enabled the researcher to populate the content of the portal. This included a facility to add HTML fragments, RSS feeds, basic searchers and web pages.

The HTML fragments refer to a feature where users are able to define a block HTML codes that can be embedded in a document. These fragments contain pure HTML codes that become transcribed into output files each time the fragment is used (Fotheringham, 2004). The HTML fragments feature was used to embed relevant web links into the portal. The web links chosen were based on the initial information requirements identified prior to the development of the static web portal.

The framework also allowed the portal to read RSS feeds from other web sources. RSS stands for Really Simple Syndication, and is a standardised format used to publish syndicated content (Hammersley, 2003; Wittenbrink, 2005). The syndicated content or feed is website content generated for use by other services (Hammersley, 2003; Miller, 2003). It can contain both the website's full or summarised text and metadata - information about the content (Hammersley, 2003). Users of RSS feeds are notified of the syndicated content's updates automatically. One of the benefits of RSS feeds to the portal's users is that it allows users to scan the headlines or read articles of interest quickly (Housley, 2004).

Besides RSS feeds, the framework allows basic searches to be integrated within the portal. This feature allows saved searches of the case university web pages to be included within the Portal. The first action research cycle findings suggest that this features was not helpful. One of the reasons was that the saved-searches only displayed static content found within the University's websites. This condition contradicts with the research students' requirements for dynamic information. The participants argued that it would be better to have a search function than a saved search, because the function would allow users to search any kind of interest. Following this, the saved searches were removed from the Portal.

The final feature of the framework was the ability to include a webpage within the portal. In addition to hyperlinks within the HTML fragments, the portal can also include relevant University web pages. However, there were several problems with this feature. For example, when included, the web pages did not display correctly. This problem was due to a different format being used when developing the source website. Therefore, the feature was removed from the final prototype portal.

A month after the computing staff delivered the first phase of the framework, another meeting was held between the researcher and the computing staff and new menu and news features were added to the framework. Meanwhile, the menu system allows the portal to create permanent menu on the top of the portal. The menus included links to the case University's Student Services' website and relevant student application systems. The menus linked to students' services websites such as 'student support', 'Union Society', 'Career', 'Accommodation', 'Library' and 'ISS' (Information Systems and Services) and student application systems such as 'eBooking', 'BlackBoard', 'PDP' and 'ePortfolio'.

The news system feature provides a facility for the portal to include specific news related to the research degree programmes. The news system is used to include dynamic content to the portal. When it was introduced, the researcher acted as news providers for the training programme. The researcher's role as news provider was only temporary, to demonstrate the applicability of the service. Entries such as notification of important dates, including the annual progression review, were generated as news and uploaded into the portal. However, later, the news system was further developed and included an RSS news feed function.

The portal was ready for evaluation after three months of developing and testing it. The screenshots of the portal that were used in the second pilot are available in Appendix C.

6.2.2 *Reflection from the action*

After necessary testing to ensure that all links within the portal worked, one focus group discussion was carried out with research students within the Faculty of HASS. Among the reasons for recruiting participants from different faculties for the second action research cycle were: (a) to test the comprehensibility of guiding topics by different discipline; and (b) to elicit any differences in user requirements.

As with the previous action research cycle, two main concerns were drawn out of the data analysis in order to simplify and focus the discussion. In terms of the focus groups conducted, the second cycle resolved the issues of location and procedure, as well as finalising the guiding interview questions. The Data- stream Laboratory proved to be the most suitable venue for this research. The procedure for the focus group included a demonstration of the portal, as well as experimentation by the participants, whilst a two-hour discussion was ample to finish the focus group's guiding questions. This was because the demonstration of the portal took time, since some participants needed clarification of some of the links or functions of the portal.

In terms of feedback on the development of the portal, two issues were raised, namely content and features. The data analysis indicated that feedback on the content was related to the information requirements needed before, during and after the research study. The data analysis also showed that the features that needed to be incorporated within the research portal included usability, customisation, personalisation and information quality. Please see Appendix H for more detail discussion.

6.3 Third Action Research Cycle

The first two action research cycles informed both the development of the research portal and the conduct of the focus group discussions. However, the second cycle also highlighted several issues related to the development of the research portal that needed to be addressed in the third action research cycle. The participants in this action research cycle comprised research students from the three faculties within the university: Faculty of HASS, Faculty of SAgE and FMS.

As discussed in Section 6.2.2, issues relating to features and functionality, as well as the content of the portal were identified as important issues to be addressed in this cycle. These issues included usability, customisation, personalisation and information quality. Furthermore, as the aim of the research to support all research students within the University, it was necessary to recruit participants from the Faculty of SAgE, Faculty of HASS and FMS.

The activities in this cycle involved planning for the development of features identified in the

previous cycle and recruiting participants from the three faculties. Section 5.1.2 discussed the steps taken in recruiting study participants. The findings of the focus groups in the second action research cycle that were related to the requirements of the technical framework were fed back to the computing staff. Two critical requirements were customisation and personalisation. Appendix H provides detail discussion of these findings.

6.3.1 *Overview of the intervention*

Several meeting were arranged with computing staff to speed things up. The computing staff delivered the final requirements for the framework four months after they delivered the first phase of the framework. After making the necessary scripting and updates, the prototype portal was ready for testing. The testing of the prototype portal was done to ensure that there were no dead links within the portal. After testing, the portal was ready to be used for the focus group. Appendix E shows the screenshots of the prototype portal used in the focus groups.

6.3.2 *Reflection from the action*

A total of six focus groups was conducted; three in the HASS faculty, two in the SAgE faculty and one in the FMS. The participants were assumed to be representative. However, the number of participants from the FMS was low. Furthermore, there were no part-time students.

As one of the objectives of the portal was to present relevant information according to research students' stages of study, the 'year of study' preference feature was used to customise the order of the portal's tabs. In theory, the aim was to display only relevant information resources (in this case information within relevant tab) based on students' stage of study. However, with a limited capability, if a user chooses '1' as his or her 'year of study', the portal's tabs will be arranged as 'Welcome', 'Applicant', 'Induction', 'Getting on', 'Developing', 'Completing' and 'Alumni'. In theory, the 'Applicant' tab should not be displayed next to the 'Welcome' tab. However, for the purposes of getting participants' feedback on the tab, it was displayed. In this case, the tabs considered most relevant to year one research students were the 'Induction' and 'Getting-on'. Accordingly, if a user chose '2' as his or her 'year of study', the portal's tabs were rearranged as 'Welcome', 'Developing', 'Completing', 'Alumni', 'Applicant', 'Induction' and 'Getting on'. In this case, the

‘Developing’ tab was considered as the most relevant to second year research students. However, the data analysis indicated that this type of customisation feature confused the user (see Appendix I).

6.4 Fourth Action Research Cycle

This chapter has so far concentrated on the three cycles of action research. This section discusses the issues identified in the previous cycle which required attention in the final cycle of the action research for this research. The participants for this action research were recruited to include part-time research students. In addition to the focus groups, interviews were also used to collect data.

The work in this final cycle continued to examine issues related to personalisation and customisation. As indicated in Section 6.3.2 views from the part-time students needed to be considered.

Based upon data analysis in the previous cycle, the researcher informed the development team. The development team updated the portal framework accordingly and delivered it once it was completed. In order to recruit part time research students, the researcher approached the Business School DBA Workshop Coordinator for help in contacting the students. In addition, the researcher also made arrangements to recruit participants from the FMS.

6.4.1 *Overview of the intervention*

Once the development team delivered the framework, necessary updates on the portal were carried out. For example, the customisation feature based on ‘year of study’ was update to reflect feedbacks from the focus groups. The following section describes the changes made.

The update resulted in enabling relevant tabs to be viewed by users, whilst disabling irrelevant tabs. For example, if a user chooses ‘1’ as his or her ‘year of study’, the portal enabled ‘Welcome’, ‘Applicant’, ‘Induction’ and ‘Getting on’ tabs whilst disabling ‘Developing’, ‘Completing’ and ‘Alumni’ tabs as in figure 20.

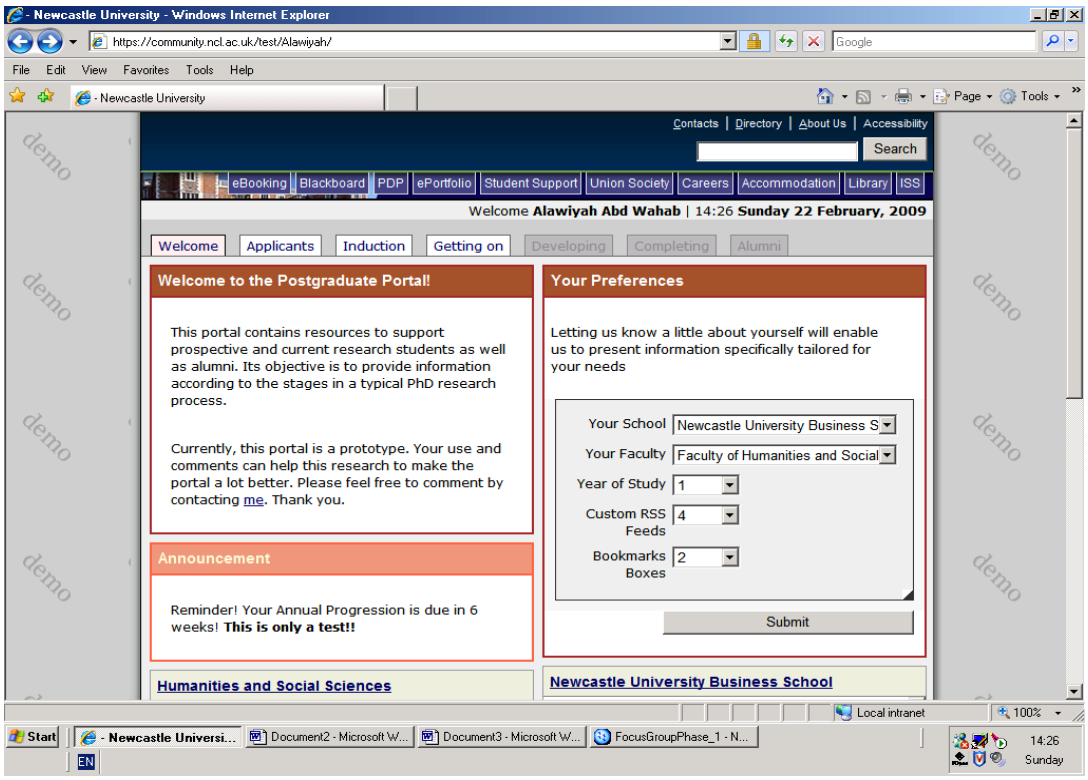


Figure 20 - The screenshot showing the enabled tabs as well as disabled tabs

Appendix P shows the screenshots of the final prototype portal.

6.4.2 *Reflection from the action*

As in all the cycles, before the updated portal was used in the data collection stage, necessary testing was carried out. Once the portal was ready, two DBA focus groups and four interviews involving one participant from the faculty of HASS and three participants from the FMS were conducted. Data analysis indicated that most participants were satisfied with the content, as well as the features of the portal. However, several issues were raised by the part time research students (see Appendix J).

6.5 Summary

This chapter has focussed on providing a description of the events that took place during the action research cycles. Overall, there were two main issues discussed in the cycles. Using the diagnosis, action planning, action taking and evaluating and specifying learning, this chapter has described the main issues as perceived by the researcher.

Chapter 7. Conclusions

The overall purpose of this investigation has been to develop and test a web portal that is able to support the dynamic information needs of research students. The existing literature reported that web-based technologies had the potential to improve and enhance the quality of learning both on campus and at a distance, yet investigations into how these technologies could be developed to support research students remain very limited.

In this final chapter the overall findings and outcomes of this research are presented. In doing so, it presents a synthesis of the study's main finding in the area of web portal design and highlights the original contribution to knowledge that has been made. Furthermore, the strengths and limitations of the current research are discussed, and recommendations for future research are offered.

It is not intended to further discuss detailed conclusions at this stage, as extensive consideration has been given to discussing the findings in the preceding chapters. Rather, the main points are brought together from all the foregoing sections.

7.1 Summary and Synthesis of Overall Findings

The first part of the literature review presented the background to web-based technologies in higher education. Most previous work has focused on supporting undergraduate and taught coursed-based learning and teaching. The second part of the literature argued that portal technology could be designed to support research-based learning. This was followed by a discussion of the domain of this research which is research degree programmes. It presented the problems faced by research students in completing their thesis, and argued that web-portal may be helpful in supporting the progress of their research study. These two literature review chapters identified the gap in the research that this study set out to investigate. In addition, the discussion of the previous literature helped to identify the purpose of this study and the research questions that guided it. Chapters four and five set out the approach and methodology used to answer these questions; introduced the context of the study, and presented the process involved in developing the web portal prototype respectively.

The overall purpose of this investigation was therefore to develop and test an e-learning model that could support the dynamic information needs of research students. This aim has

been achieved. The findings and discussion of the action research were presented in Chapter 6 Results and Discussion and are summarised below:

- A web portal that is capable of supporting the information needs of research students throughout their research study life cycle, and that provides a personalised 'one stop centre', has been developed;
- The kinds of information resources needed change as research students progress through the research life cycle, and this is reflected in activities at each stage of the research life cycle;
- Research students preferred information resources that are personalised, relevant, authoritative and current;
- Features and functions desirable for an e-learning research portal include, but are limited to integration, security, usability, personalisation and customisation.

The study revealed an overarching theme, that of the value of relevant and personalised information resources. As people now depend heavily on the Internet for information, especially in education, providing comprehensive and complete information resources is critical to the success of an educational institution.

7.2 Contribution of the Thesis

Having summarised the findings of this study, this section highlights how the work makes an original contribution to knowledge. The following three points are offered as contributions that have been made to the field of e-learning, specifically with regard to research education:

i. The design of a web portal to support research students through out their research life cycle has been developed and validated through the action research cycles;
ii. A technical contribution in terms of the web portal prototype that prove useful in demonstrating the design of research support;
iii. The reflexive accounts of the action research process.

Although the study does not seek generalisation to other cases, it is considered that the case may have a wider resonance within higher education, and that there may be some areas of commonality between this case and others, and that the findings may be generalizable to some other settings. The aspiration was that the study will increase overall understanding of the e-learning requirements of research students and contribute towards others' cumulative

understanding of e-learning in general. It is envisaged that the work will be of value to higher educational institutions, designers and developers who wish to implement or develop an e-learning initiative to best support research students.

The work is significant in that as far as can be discerned, it differs from that of previous studies in the following aspects. First, the study focussed on the research students' perspective, rather than on that of taught students. Thus, the findings of the study broaden the web-based technologies literature to include perspectives from the research student domain. Second, it concentrated on understanding the requirements of research students that contributed to their satisfaction before full-scale portal development can be pursued. Third, by taking a largely qualitative approach, the work captures the essence of research students' information and resources support by giving a voice to the respondents, and avoiding imposing predetermined response categories of information resources type and online features. The study unearthed data that has revealed how a web portal could be designed to support research students throughout the research life cycle. This has provided an insight into the requirements of research students toward online support, thus filling a gap in the literature. Last but not least, this research pioneers a life cycle approach to supporting research students throughout their study through online provision, whilst most previous e-learning research aims to provide only a specific application to support a specific task.

7.3 Strengths and Limitations of the Thesis

This research employed an action research approach. In doing so, it has demonstrated the value of this strategy for investigating studies of this nature, which seek to gain an understanding of research students' requirements toward an online provision of information and resources support. The action research approach strengthened this research through the ability not only to study dynamic issues in the research programme setting, but also the effects of intervention. Furthermore, as this research aims to investigate research students in their natural setting where no control over events is possible, the action research approach is suitable, as it facilitates research under this condition. Moreover, by utilising the action research approach, the thesis was able to employ a variety of data collection techniques which allow for data triangulation. This, in turn, strengthened the reliability and validity of the study.

As a research student herself, the researcher was familiar with the nature of the research

degree and its associated challenges. Therefore, she was able to understand and gain in-depth and valuable information from the research students involved in the study. Yet the problem of researcher bias became unavoidable and required delicate management. As discussed in Chapter 5, in addition to being an intermediary between users and the technical team, the researcher also acted as a developer of the web portal. This gave the researcher a means of establishing a close relationship with the users, and at the same time, the researcher also formed her own understanding with regard to the relevant information resources and portal technology. Nevertheless, this might have endangered the value of the research outcomes. However, by adopting interpretivist assumptions, the researcher managed her bias by using data triangulation to gain multiple perspectives on the issues. Another advantage of being in this role was that the researcher was able to encourage the participants to provide more open and honest accounts of their evaluation. This would not have been possible if the researcher had assumed the role of tutor, which would have placed her in a position of power over the participants. In such situations, participants' responses may be adversely influenced; hence the validity of the research would also be affected.

In Chapter 1, the definition of e-learning was given as the use of web-based technologies to support learning. The argument that the integration of different application systems into one environment is critical for successful e-learning led to the identification of the portal as a suitable technology. However, given the lack of time, budget, manpower and personal expertise, not all requirements gathered in this study were implemented. Therefore, the evaluation of the web portal, which aimed to assess its utility with respect to the requirements gathered, was not fully realised. It is hoped that future study might focus on the development of a web portal application that will take into consideration the requirements and features proposed in this study, to realise its full potential in supporting research students.

7.4 Suggestions for Future Research

This thesis provided a number of insights in relation to the development of the web research portal to support students in their research degree programmes. However, it left a range of issues that could benefit from further academic study.

The first recommendation for future work is to consider other research methods such as design science research for conducting this kind of study. Although the action research

approach was appropriate for this kind of research, as has been discussed and justified in Chapter 4, design science research could offer different kinds of theory and practical knowledge that would be beneficial to the e-learning area.

The second suggestion for future work is to consider extending this research by considering the use of survey research to test the students' requirements with a more diverse group of research students. By deploying survey research, a statistical generalisation of the findings regarding the research students' requirements toward a web portal application may be achieved.

A further area of research that would be of value is the evaluation of the impact of a web portal application on the research process, as well as the progress of research students. This kind of study could shed lights on the features and functions of a web portal application that enhance or detract from the progress of the research study.

Reflecting on my experience on action research, there are some considerations future PhD candidates could learn if they wanted to employ action research in their study. These recommendations are solely based on my experience. I'm aware that it might not apply to all situations. However, to some extend, I believe these recommendations would be beneficial to those students who have different philosophical views than what they intended to do upon entering a PhD study. Based on my experience, coming from a very positivist and quantitative perspective, it was quite difficult for me at the beginning to understand how to conduct a qualitative, let alone an action research study. The notion of action research that considers a researcher's reflection as one source of data is very difficult for me to accept and apply. I think the reason is that I was not exposing to this kind of thinking before. In part, this might be because the education system that I have gone throughout my schools and colleges years did not prepare me well in this regard. In particular, the high level of autonomy for action researcher and a constructivist view of knowledge that characterise action research. I believe some training would likely be helpful in approaching and conducting an action research study. Furthermore, a proper guide from experience researcher in action research would be very beneficial. As argues in Adams (2010), learning acquired through critical discourse and experience sharing is one of the trademarks in transformative learning which characterised one action research feature.

7.5 Overall Conclusion

This chapter has summarised and synthesised the main findings of this study, highlighted its contribution to knowledge, examined the strengths and limitations of the research and forwarded a number of areas that are worthy of future research. It is hoped that the key impact of the development of the e-learning research portal will be the unique insight that it has provided into research students' requirements, and that the findings will help higher education institutions, designers and developers to identify how to best support these group of learners through e-learning. Though this research was based on action research study, it has provided a foundation to investigate research students' requirements toward e-learning on other campuses that have similar background and characteristics to the case institution.

Appendix A Testing Template

Postgraduate Research Portal User Testing

Testing Template

Tasks	Yes	No	Comments
NAVIGATION			
Is it easy to scroll up and down the screen? Does the back button work? Any other comments on navigation?			
OTHER FEATURES			
Do the links work?			
Any comments on the other features?			
ANY OTHER COMMENTS ON THE PORTAL?			

Questions

1. Do you think it is easy to learn to use the Portal?
2. Once learned, is it easy to use the Portal?

Appendix B Sample of Cycle One Topic Guide

Opening questions

1. Would you please introduce yourselves – name, from which school, please also briefly describe your PhD.

Introductory questions

2. Our primary focus here is to understand your information needs, needs for information that arise before as well as while pursuing your PhD. First, we would like you to think back to when you were applying for a place at a university. What kind of information you were looking for/using.

   Let us start a round robin to build a list. Please each list one and we will write on the board. As we go around feel free to indicate whether the responses of those before you match your most common needs but see also if you can expand the list.

   Probe:
   a. Where do you get your information (from which source)?
   b. Any resources that you found useful.
   c. Can you tell me any university sites that impressed you?
   d. Why do you choose Newcastle?

****Transition questions**

3. Now, is there any information that was important but you could not find or was not available?

Key questions

4. In your opinion, what kind of information that you think you need during your induction week.
   Probe: Do not assume that the students will remember all of these documents or what they mean.
   a. Just to check, how many of you went to the induction.
   b. For those who went, do you had with any difficulties?
   c. Is there any information that was important but was not given to you during induction?

5. What kind of information that you think you needed after induction or while in your first year?

Probe:
   a. Are there any online resources you would recommend for inclusion?
   b. Are there any issues that should be additionally included in the portal?
   c. What do you think of the research training programme?
      i. How helpful was the training?
      ii. Did it contribute to your research or did it distract you from your research?
   d. How about the format of delivery? Would you prefer if the training is offered on block format like instead of a few hours per week, it is offered as a one week block.
   e. What did you need that you did not get from the training?
   f. What did you get but you did not need?

g. Do you prefer personal study (through book, Blackboard and internet resource) or attending lectures as in the research training programme?
h. What do you think of Blackboard?

6. What kind of information that you think you will need/needed while you were in your second year?
   Probe:
   a. Are there any other issues that should be included in the portal?
   b. Any good online resources you would recommend?
   c. How about the format of delivery? Would you prefer if the training is offered on block format like instead of a few hours per week, it is offered one week block.
   d. What did you need that you did not get?
   e. What did you get that you did not need?

7. What kind of information that you think you will need/ needed while you were in your final year?

8. What kind of information that you think you will need/needed when you leave the university, as alumni?

9. Now, would you please identify which of the information given is specific to your own research? Or can you please tell me the information that you think is specific to your research but haven't been mentioned yet?

10. Demonstrate the portal

Final – have we missed anything?

11. Is there anything that we missed? Is there anything that you came wanting to say that you did not get a chance to say?

Appendix C Sample of Cycle Two Topic Guide

Opening Questions

1. Would you please introduce yourselves briefly– name and your PhD
2. My primary focus today is to understand your information needs – what kind of information do you need to support your research tasks.

Demonstrate the portal to the participant. First, show the 'applicants' menu to them follow by the introductory questions below.

Introductory Questions

3. Which information on the portal that you found helpful
4. Which information on the portal that you thought was missing

Demonstrate the 'Induction' menu follow by key question 5

Key questions

5. Which information on the portal that you found helpful
6. Which information on the portal that you thought was missing

Demonstrate the 'Getting on' menu and follow by key question 7.

7. Which information on the portal that you found helpful
8. Which information on the portal that you thought was missing

Demonstrate the 'Developing' menu and follow by key question 9.

9. Which information on the portal that you found helpful
10. Which information on the portal that you thought was missing

Demonstrate the 'Completing' menu and follow by key question 11.

11. Which information on the portal that you found helpful
12. Which information on the portal that you thought was missing

Demonstrate the 'Alumni' menu and follow by key question 13

13. Which information on the portal that you found helpful
14. Which information on the portal that you thought was missing

Final – have we missed anything?

15. Is there anything that we missed? Is there anything that you came wanting to say that you did not get a chance to say?

What do you think of this approach (The Postgraduate Portal as a centre for electronic resources)? Do you find it useful? Why?

Appendix D Personal Information Sheet

Research Title:	E-Learning in Postgraduate Research Education: Investigating and Evaluating Portal Applications in the PhD Research Process
Researcher:	Alawiyah Abd Wahab PhD Candidate, the Business School, University of Newcastle Email: Alawiyah.Abd-Wahab@ncl.ac.uk Telephone: 07723408021

Brief Description of the Research:
This research involves developing a postgraduate portal. A portal is defined as web pages that act as a starting point for using the web or web services. In this research, the Postgraduate portal is intended to be a starting point for students to access relevant PhD resources and other University applications. The purpose of this portal is to support all research students by providing relevant resources at each stage of their research.

In order to determine the content as well as evaluating the portal impact, I decided to conduct interviews to identify the information needs of research students. I would like to invite you to participate in an interview. In this interview, we will be discussing the kind of information that you think you need to support your study at each stages of your research.

Personal Information

Name:

Contact number:

Email:
Are you a home or overseas student?

☐ Home ☐ EU students ☐ Overseas student

Academic Information:

Course:
Year of study:
School:
Mode of study: ☐ Full time ☐ Part time

Appendix E Topic Guides for Cycle Three and Four

Guideline:

1. Would you please introduce yourselves – name and school
2. My primary focus today is to understand your information needs – what kind of information do you need to support your research tasks.

Research tasks

a. Develop a PhD proposal
b. Annual Progression
c. Undertaking literature review
d. Develop methodology
e. Writing thesis
f. Writing paper
g. Attend conferences
h. Viva
i. Thesis submission

Working in pairs, would you please discuss and identify information resources that you need, how do you find the information and the sources of the information.
Probe:
What other tasks that you might think of?
Any resources that you found useful?
University sites that impressed you?
Any information that you could not find?

3. Demonstrate the Portal – Feedback on the prototype portal
4. Feedback on the welcome page
    a. What do you think of the school news/events, faculty's news/event
    b. What do you think of the RSS feeds facilities
    c. Probe:
        i. Could you tell me some more about that?
        ii. What do you mean by that?
        iii. Anything else?
        iv. What do you think, Amy?
        v. What do other people think about this?
        vi. How does A's point relate to the one that you raised, B?
        vii. What do you think about J's suggestion?
5. Feedback on the induction
    a. Which information do you find useful/not useful
    b. What other information that you would like to be in the portal?
    c. Any online resources that you would like to recommend?
6. Feedback on the Getting on
    a. Which information do you find useful/not useful
    b. What other information that you would like to be in the portal?
    c. Any online resources that you would like to recommend?
    d. What do you think of the features of personalisation?

7. Feedback on the Developing
    a. Which information do you find useful/not useful
    b. What other information that you would like to be in the portal?
    c. Any online resources that you would like to recommend?

8. Feedback on the Completing
    a. Which information do you find useful/not useful
    b. What other information that you would like to be in the portal?
    c. Any online resources that you would like to recommend?

9. Feedback on the Alumni
10. General
    a. What was particularly helpful about the portal?
    b. What advice would you give to improve the portal?
11. What do you think of this approach? The use of portal to support research students? Do you think its' useful? Why?
12. Final
    a. Is there anything that we missed? Is there anything you came wanting to say that you didn't get a chance to say?

Appendix F Topic Guides for Interview

Guideline:

1. Demonstrate the Portal – Feedback on the prototype portal
2. Feedback on the welcome page
    a. What do you think of the school news/events, faculty's news/event
    b. What do you think of the RSS feeds facilities
    c. What do you think of the features of personalisation?
    d. Any other features that you think would be useful to support your research?
    e. Probe:
        i. Could you tell me some more about that?
        ii. What do you mean by that?
        iii. Anything else?
3. Feedback on the induction
    a. Which information do you find useful/not useful
    b. What other information that you would like to be in the portal?
    c. Any online resources that you would like to recommend?
4. Feedback on the Getting on
    a. Which information do you find useful/not useful
    b. What other information that you would like to be in the portal?
    c. Any online resources that you would like to recommend?

5. Feedback on the Developing
    a. Which information do you find useful/not useful
    b. What other information that you would like to be in the portal?
    c. Any online resources that you would like to recommend?
6. Feedback on the Completing
    a. Which information do you find useful/not useful
    b. What other information that you would like to be in the portal?
    c. Any online resources that you would like to recommend?
7. Feedback on the Alumni
    a. Which information do you find useful/not useful
    b. What other information that you would like to be in the portal?
    c. Any online resources that you would like to recommend?
8. General
    a. What was particularly helpful about the portal?
    b. What advice would you give to improve the portal?
9. What do you think of this approach? The use of portal to support research students? Do you think its' useful? Why?
10. Final
    a. Is there anything that we missed? Is there anything you come wanting to say that you didn't get a chance to say?

Appendix G Action Research Cycle I

This appendix presents and discusses the findings from the analysis of action research in cycle one. The information resources identified in the first action research cycles were categorised into resources required to support the main research tasks at each stage of the research study. Research students' information needs were elicited based on the general structure of the life cycle of the research degree developed in section 3.1.4. Based on the structure, research students normally follow six stages in their research degree life cycle starting from applying to an institution, attending induction sessions, getting on, developing, and completing their research and finally graduating and becoming alumni. However, as discussed in Chapter 6, because of time constraint the focus group was cut shot. Hence, the researcher was able to elicit research students' information requirements only in the application and induction stage.

Stage 1 - Application

The 'Application' stage is considered to be the beginning of the student's life cycle as a research student. During this stage, research students were looking for an institution to undertake a research degree. The analysis of the focus groups' transcripts reveals that in addition to the information resources currently available on the portal, the participants commented that information regarding the academic facilities such as accommodation, laboratory equipment, availability of full-text journals and books through the library are important. Information regarding accommodation was identified as critical to European and international students. As one participant noted:

"First and foremost, I would say accommodation. When I decided to come to Newcastle, the first thing I did was applied for the University accommodation, but in the end, they denied my application because I was not considered as overseas. The problem is I could not find anything on the website that said I was not eligible for accommodation".

P1_ARCycle1

The issue of guaranteed accommodation was heavily debated among the participants. The analysis suggests that some of the participants were not really clear who is considered as an international student by the University. A participant from European countries assumed that she was an international student and applied for University accommodation, however was frustrated when her application was denied. She later was informed by one of the participants that a student is considered an international student if they pay an international fees. The

analysis shows that clear and easy to understand site content is essential for a successful system. The analysis found that it is critical to provide an easy to understand and clear explanation of the content of the websites.

The participants also considered information resources relating to facilities for supporting research, such as laboratory equipment, as important. One participant argued that she was interested in knowing whether an institution had laboratory equipment to support her research. This was critical to her, as the reason she want to do her research degree abroad was to experience the cutting edge technology which was not available at her own institution. She argued that she could apply the experience and knowledge she gained to developing her country. The following quote demonstrates her argument:

"I was more concern about facilities, for example, back home especially at my university; we don't have really equipped laboratory. What I mean is the equipments that can support my research in Marine Technology such as the twin tank laboratory. It would be worth it to come all this distance if you can experience with complete laboratory equipment".

P4_ARCycle1

The information regarding the facilities and services provided by the University libraries was also considered as essential. The participants were interested in knowing the availability of subscribed full text journals and books. Participants argued that subscribed journals without full text content were not as helpful as full text content. They wanted to be able to read the whole paper rather than only the abstract. Even though they could get full text articles through the inter-library loan service, they would prefer the University to have the copies. They argued that if most full text articles were available through the University libraries, this would be acceptable. As one participant commented:

"Back home (referring to her country), it was not easy for me to get full text journal articles, so I'm expecting the institutions that I applied for to have these facilities".

P4_ARCycle1

Of the 7 participants, two expressed an interest in information resources on areas of research available at an institution. In addition to the area of research, one participant pointed out that she was concerned about the credentials of the academic staff who would be involved in her topic, as in the following quote:

"I think before I applied to PhD, I wanted to know more about the people who are involved with the PhD and what research background they had, and to know if they were any good. I didn't want to go to a university that had no respect for my PhD work".

P2_ARCycle1

When discussed further, she added that she would check the research and publications of academic staff to determine their credentials. She argued that the credibility of academic staff could be determined by the number of times an academic staff published in high ranking journals. She shared her experience, saying that:

"One of my supervisors was actually a professor, she was very well respected and as soon as I knew her name, I started asking people. I found out she is really good and published in well respected journals. So that is important to know …"

P2_ARCycle1

Stage 2 - Induction

The second stage in the research students' life cycle is called the 'induction' stage. During this stage, students attend various induction programmes conducted either at the school or faculty level. Owing to time limitations, only partial information requirements were identified from the first action research cycles. Information resources identified as essential to research students during the 'induction' stage can be categorised as follows: information for new students, rules and regulation of a research degree and information regarding the research training and taught postgraduate modules.

Information resources identified as essential to new students included providing guidelines on how to open a bank account, finding private accommodation and available student clubs and societies within the university. Of the seven participants from the Faculty of SAgE, three suggested that an institution should provide detailed guidelines on how to open a bank account. All international non-European participants claimed that they had a bad experience in dealing with opening a bank account. One participant demonstrated her difficulty in the following quote:

"I found it very difficult to open a bank account here. I think I went to three banks before one of them accepted my application. The first bank rejected my application simply because, according to them, I did not have the right format for my reference letter. The second bank asked me to book online for an appointment and told me I have to wait for a month before I could open a bank account. I said forget it. Then, I went to [bank name] bank and they accepted my application".

P7_ARCycle1

Based on the analysis of the transcripts, participants reported that they had problems finding private accommodation. Since European students are not guaranteed accommodation, one participant, for example, commented that information on finding private accommodation would be useful to him as in the following quote:

"It might also good to provide tips on how to get private accommodation. I think the university already provided a lot of information on University accommodation. But I don't know about private accommodation. For students from abroad or from different cities like me, this kind of information would be useful".

P5_ARCycle1

During the discussion, many suggested that the problem of finding private accommodation could be minimised if they knew where to go or who to ask. Further analysis showed that students who have contacted their friends or student clubs have fewer problems in finding private accommodation. Thus, it is vital that information on the available student clubs and societies should be given to new students.

The findings of action research cycle one illustrate that the majority of participants were interested in having summarised versions of documents related to research degree regulations or policies, as well as the complete versions. The reason given for this was simply because a summarised version would be more appealing to read. In particular, participants expressed their need for a condensed version of the Code of Practice, Research Training Handbook and Handbook for Research Student and Supervisor. Two participants commented on this issue:

"I know it would have been useful because they gave you the handbook and code of practice, and you would think, 'Oh, I'm so not going to read that'. I did eventually flip through because I was wondering how many hours am I expected to work, what is it they want from me, what am I allowed to do, what am I not allowed to do. So, if there was a bullet point condensed version of the code of practice, that would be great".

P2_ARCycle1

"I think you have to know what your rights are, or what you have to do and what you don't have to do, so indeed like a bullet point version will be very useful".

P5_ARCycle1

A further information resources identified as required during the induction stage was information about personal safety. Personal safety was considered important especially for

single female students. One participant expressed her view on this matter:

"I think information on personal safety is important to me, as I'm a girl and living here alone. I need guidance such as where and when it is safe to walk alone. I know from my friend that it is not advisable to walk alone after 8 at night".

P4_ARCycle1

Of the seven participants from the Faculty of Sage, three talked about the need to have information about the students' right to have appropriate facilities including a study desk, a computer, printing and conference funds during the induction programme, whilst two participants felt that information about personal safety should be included during the induction programme. One participant said that he needed information on the modules available to taught-Master programmes, since he needed to attend some of the modules offered at Masters level as part of his research.

The Functional Requirements: Features and Functions

In addition to identifying the additional information requirements of research students, the participants also evaluated the current information requirements (links) as well as the features and functions for an e-learning research portal. Some issues regarding the features and links are described below.

Usability

One participant suggested that a brief explanation beside each link could make the links clearer.

"I think it will be more useful if you can add a brief description besides each link. Some of the links are not self-explanatory so it needs a clear description".

P7_ARCycle1

Appendix H Action Research Cycle II

The findings of the action research cycle two can be categorised into two main findings: information and functional requirements. The following sections discuss the details of the findings.

Information Requirements:

Stage 1 - Application

Overseas students who have a sponsorship argued that they needed information regarding the rating received by every area of research. One participant suggested that he used the Research Assessment Exercise (RAE) score to decide which institutions to apply to. The following quote demonstrate the information needed for the RAE score:

"As I'm a sponsored student, I need to know the rating of my area of interest. My sponsor only allows me to apply to institutions with a high RAE scores".

P4_ARCycle2

As the main task for prospective students is applying to an institution, the information relating to the procedures to apply to an institution was considered critical to participants. One participant argued that there should be a clear guide within an institution's websites or prospectus on how to apply for a research degree. One participant shared his experience of the difficulty he faced when helping his cousin to apply.

"Last year my cousin asked me where he should send his application form because he couldn't find an address on the application form. I also checked but could not find it. I thought we could only apply online, so I don't know how to help him…"

P5_ARCycle2

Later, one participant explained that the application form provided was a general application that can be used by all applicants. However, when applying, an applicant should send the application form to the appropriate Graduate school. This is why there was no address on the application form. However, when the researcher checked the current PDF version of the application form, the three graduate schools' addresses were shown. This scenario suggests that a personalised application form would be useful for prospective students.

In addition to clear guidelines on how to apply, one participant was particularly interested in information regarding tuition fees. She argued that tuition fees were an important factor for her in deciding which institution to apply to, as illustrated in the following quote:

"… the fees are useful (because) actually my selection of university will depend on the subject of my interest as well as the fees. If the fees were very expensive, I would not choose it".

P2_ARCycle2

In addition to the fees, two other international students said that they were concerned with other costs. They mentioned that accommodation and living costs also played an important role in determining which institutions to apply. One participant even suggested that an institution should provide general information regarding the average cost for a student's meals as in the following quote:

"I think it would be most useful if I can have information on the tuition fees, living cost, accommodation cost and the cost of food as well. I have seen a cost chart for food, wine and meal on one of the Australian university websites".

P4_ ARCycle2

One participant regarded information about the life as PhD students including the general idea about a PhD study, the number of hours a PhD is required to work and the social activities available as important before he started his study. He suggested that information resources on mentoring systems, a city and its surrounding area, available clubs and societies would be useful to prospective students. Participants also suggested that testimonial quotes from existing PhD students would be useful to give some indication of a particular institution. The following quote demonstrate this point:

"There are these pages within the Newcastle University websites where students who are actually studying in the university talked about what they think about the Newcastle city. You know it's like….a testimonial of what you think about the Newcastle city … So I think you can have a link to these pages from your portal".

P1_ARCycle2

Finally, one participant commented that the link to the information resources regarding research proposal writing was useful. She explained that when she was applying, there were no guidelines on how to write a research proposal. The guideline gave some ideas on how to start writing a research proposal.

Stage 2 – Induction

Almost half of the participants agreed that the information provided under the 'Induction' tab was complete. However, some additional links were suggested such as links to available

undergraduate or master courses page and links to information about available seminars organised by particular school. Furthermore, participants also raised some issues about the current links on the portal. For example, some participants suggested that the saved searches portlet should be developed as a search page as one participant commented:

I think it might be a good idea just to leave (that) as a search log.

P1_ARCycle2

Participants also suggested that the portal presents personalised information content to the users.

Stage 3 - Getting-on

The 'Getting-on' stage can be considered as a stage where research students are attending research training programme modules and developing their research proposals. The developing of the proposal involves students carrying out an extensive literature review. The information resources identified as essential to support these tasks include information on the research training modules, the application systems related to the training including Blackboard, e-booking system, Personal Development Plan, e-Portfolio, and the research training website.

When commenting on the funding resources link (HEFCE/research councils), one participant argued that funding bodies should be presented separately. This is because each of the funding bodies (in this case HEFCE and research councils) serves different purposes, as identified by the following quotes:

"I think you should separate between the public funding bodies such as HEFCE and the research councils because the former do not fund PhDs, if they do it will be very marginally, however, the research councils such as EPRSC, ESRC and etc. do fund PhD students and they fund a lot".

P1_ARCycle2

In addition to commenting on the available links within the portal, participants also suggested additional information resources that they thought would be useful in the getting on phase. This includes information resources on taught courses and research training modules.

As certain students needed to attend courses to strengthen their knowledge about particular domains in their areas, they were interested in knowing where they could find information on available undergraduate or masters level modules. As is the practice at the case university,

research students were allowed to register for non-credit bearing modules if recommended by their supervisor. The problems that these participants reported were finding the modules for particular subjects. As they were new students, and some were from abroad and not familiar with the system at the case University, searching was problematic. The analysis of University websites showed that students needed to have experienced taking undergraduate or masters level courses to be able to find the link to the information on master level modules. The visibility of this link in the portal can enhance the accessibility of the information resources.

Besides information on the taught courses modules, participants also suggested that detailed information about the research training modules should be available through the portal. In particular, they were interested in the details of each module offered, including its description, timetable and assessment method. The following quote demonstrated this information need:

"I agree with [P3], we need detailed information about research training modules, especially modules timetable and assessment. Because you know, the first year we have to take five modules. I did not find it here (getting-on)".

P5_ARCycle2

Stage 4 - Developing

The 'Developing' stage can be considered as the stage where research students are developing their methodology and planning data collection, as well as analysing their findings. During this stage participants reported that they would appreciate having information resources regarding the conferences that they could attend. One participant in particular commented that any conferences organised either within or outside the University should be available to research students.

"I think it is a good idea to put…may be some headline for the conferences… because you know it is very important in the second that we present our research. May be you can put a link to HASS postgraduate conference or any conferences listing website".

P5_ARCycle2

Other information resources identified as relevant to research students at this stage were information related to methodology. Participants were keen to have information on different types of methods within quantitative and qualitative paradigms as well as methodological books to be available online.

"If I'm in my second year, I am possibly more interested to look for information related to methodology suitable for Business study. If you have a look at the Blackboard on the DBA site, you can find really good links to methodology resources".

P3_ARCycle2

Stage 5 - Completing

The 'Completing' stage can be considered as the stage where research students are finishing their research. During this stage, they will write up their thesis, prepare for the viva, and submit their thesis.

Participants identified different kinds of information that they felt should be available to them when they are in the completing stage of their research. Two participants suggested that information regarding the process of submitting a thesis should be available to research students. The research students should be aware of the rules and regulations regarding thesis submission prior to submitting, as this information would help them prepare for their submission and thus avoid any delays as commented by one of the participants:

"I think it is a good idea to make a link to the process of how to submit your thesis, how to follow up the submission of your thesis to the library and about the binding of your thesis. If you are aware of the process, I think you can avoid any delay related to the technicality of the submitting process".

P5_ARCycle2

Other information identified as important was related to career options, including information about any postdoctoral works available within or outside of university for research students. One student suggested a particular website that research students could check to find out the career options after they finish their PhD, as illustrated in the following quote:

"Actually, there is an interesting page here … what are the other career options after you finished your PhD? So this is the GRAD page, "what do PhD do"? You can check this page out for more information".

P1_ARCycle2

Two participants suggested that it would be a good idea to have information about the congregation ceremony, particularly the cost of attending the ceremony in the completing stage, as in the following quote:

"It should be in the completing stage, you know about how much it costs to hire the graduation gown and so on … of course this is important, it is about money, isn't it?"

The analysis revealed that several links were perceived as irrelevant to the stage of study associated with them. For example, a link to a research funding site was placed within the 'Completing' tab. All participants from the second action research cycle agreed that the link was more suitable if it was placed within the 'Induction' tab, as in the following quote:

"I think it is a good idea to place it (getting funding link) at the beginning of induction…because the students need the funding or the scholarship from the beginning of their study not at the end of their study".

P5_ARCycle2

Stage 6 – Alumni

The 'Alumni' stage can be considered as the stage where research students already completed their research degree and are pursuing their career. When asked what information research students would need after they left the university, one participant suggested that information on past PhD holders and their career would be useful on the alumni section.

Table 28 shows the general comments on the information resources (links) available on the static portal during action research cycle I and II.

Stage	Information resources	Determined during		Comments
		Documentation	Cycle 1 & 2	
Application	Procedure of How to apply	√		Useful
	Fees	√		Important
	Accommodation	√		Important
	Academics profiles		√	Important
	Information about Schools and Faculties (research area)	√		important
	Accommodation	√		Important
	Research facilities (i.e., laboratory equipment)		√	Important
	Living cost (accommodation, food etc)		√	Important
	The City	√		Good to have
	The library resources (full text access)	√		Important
	The RAE		√	Need to know
	Union: jobshop		√	Useful
	How to write a research proposal	√		Useful
	Student testimonial		√	Need to have
	Link to "registration to entry" webpage		√	Good to have
	Introduction to research study		√	Good to have
	Language support and training	√		No comment
Induction	PhD rules and regulations	√		Important
	Code of Practice document	√		
	Clubs and societies		√	Need to have
	Learning contract	√		Okay

	Induction checklist	√		Okay
	Graduate schools	√		No comment
	Intellectual property	√		No comment
	Appeal procedure	√		No comment
	University computing service	√		No comment
	Disability/accessibility	√		No comment
	Welfare	√		No comment
	Plagiarism	√		Move to getting on stage
	Reflective practice	√		No comment
	Safe research/security fire	√		No content at this time
	Blackboard	√		No comment
	e-portfolio	√		No comment
	Map		√	Important
	Personal safety		√	Important
	Finance matters: opening a bank account		√	Important
Getting on	Information about master modules (what courses are offered, etc)		√	Need to have
	Information about seminars		√	Need to have
	Writing successful proposal	√		Move to completing stage. Not suitable here because it is for applying for a grant not for a research study.
	Mentoring	√		Good
	HEFCE/research councils	√		Split into two links
	Research training modules	√		Need more information
	Managing meeting agenda and minutes	√		No comment
	Managing your PhD	√		No comment
	Writing skills	√		Change to a more appropriate name
	Preparing to teach and demonstrate	√		No comment
	Progression	√		No comment
	Skills audit	√		No comment
	Presentation skills	√		No comment
	How to write a report/paper	√		No comment
	Language centre training	√		No comment
	Library/EndNote	√		No comment
	Writing and communication skills	√		Change to a more appropriate name
	UKGrad page		√	Good to have
Developing	IPR	√		Important
	Career Development	√		Interesting
	Networking	√		Important
	Professionalism	√		Important
	Research governance	√		Important
	Enterprise and Innovation	√		Important
	Small Enterprise research unit	√		This link is

	(SERU) – learning by doing			specific to the case university
	Researcher in residence	√		Okay
	Building quality and quality assurance	√		No content . therefore no comment
	Critical thinking and originality	√		No comment
	Research Training Programme modules	√		Mixed reaction
	Information technology skill	√		No comment
	e-booking system		√	Good to have
	Publication process	√		No content at this time – so no comment
	Conference alert (internal + external)		√	Good to have
	Resources on methodology		√	Good to have
Completing	Understand yourself	√		No content at this time
	Thesis format and structure	√		More personalised content
	Reference style		√	Good to have
	Procedure of how to submit your thesis		√	Need to have
	Getting research funding	√		Suggested to be moved to induction stage
	Information on congregation		√	Should have, important
	Career planning	√		Good to have
	Postdoctoral advert		√	Good to have
	Handling large document	√		No comment
	Handling the media, marketing and publicity	√		No comment
	Knowledge transfer partnership	√		No comment
	Prep ring for the viva	√		No comment
	Peer review	√		No comment
Alumni	List of alumni and their job/position		√	Good to have
	Managing contact	√		No content
	Keeping up to date	√		No content

Table 28 – General comments on information resources during the action research cycle 1 and cycle 2

The Functional Requirements: Features and Functions

The prototype portal used to assist participants at this stage was developed with minimal functionality. The portal only supports a content repository, without the ability to customise its contents. What this means is that users are able to view all the tabs as they wish. An example of the interface portal is shown in Appendix L.

Usability

The usability issues were one of the major concerns raised by the participants in the first two

action research cycles. The majority of participants commented specifically on the wording used to name links within the portal. Two participants argued that some links did not represent its content, as in the following quotes:

"You got number one 'Writing skills' and number five 'Writing and Communication Skills' and I clicked on both of the links and found that they really tells different things. So, if it is possible, can you change, may be change it to something more compatible to what the content tells us".

P2_ARCycle2

"I agree with [P2] on that, I also found in the 'Related Materials' portlet that the link 'web skills and e-literacy' did not correspond to the content that it linked to. I think you should change it".

P6_ARCycle2

"The 'Postgraduate admission portal' link is supposed to make it easy for applicant just to click it and trace their applications progress, because how do people actually know clicking 'Application form with a research proposal', and they can check their progress, the title itself doesn't really give that information, so I think title 3 actually will give a clear direction. If you want to check your progress, you click number three rather than number two".

P6_ARCycle2

The other usability problem identified was that of site navigation. Two participants argued that it would be more useful if they could get to their desired content without having to pass many links. For example, the following quotes show the interaction between the interviewer and one of the participants:

"If you look under academic facilities for applicants, it shows the 'Welfare' and the 'Housing' links, if you click on 'housing' it will link you to the accommodation webpage".

Interviewer

"Yeah I know that. It will link you to that accommodation page. But as I told you that I want to link to the cost of accommodation straight away, I think it should have some kind of a short way to go to that page".

P4_ARCycle2

Customisation

The features identified as necessary for the postgraduate portal is customisation. As the current portal allows users to access all tabs, participants became confuse as to which tabs' contents were relevant to them. One participant commented that:

"I think [interviewer name], if you can specify which tabs are for which year so that student knows which is applicable for him.

Because I don't think, it is a good idea for the student to access all tabs to find the good information for him. If I want to access to this website and I want to find some useful information, may be I have to access to all of them. But if I know that this tab is for the first year, so I will not go to the first year tab, I will only access the tab that is relevant to my year quickly without the need to open many tabs".

P5_ARCycle2

Personalisation

In addition to customising the portal's content to reflect year of study, participants also suggested that more personalised content should be provided within the portal. One participant commented on a link as follows:

"You provided here the 'Thesis Format and Structure' link and I noticed it is for the Chemical Engineering and Advanced Materials students. Well, possibly their layout is quite similar to the social science, I mean the format is similar to ours. But it is just little things like citation style, obviously for science they have got a difference way of citating to us. I don't know how relevant the link is to the social sciences PhD".

P6_ARCycle2

Information Quality

In terms of the content of the links within the portal, the analysis showed that participants were concerned over their currency of information. The following quote illustrates this point:

"I think you should check whether the link that you placed here is updated regularly, since I think out of date content is not useful at all. I would come back if I found that it is updated regularly".

P4_ARCycle2

Other Features and Findings

In addition to analysis of the early evaluation, further analysis of the transcripts revealed more findings. The analysis of the second action research study transcripts showed that participants were concerned with the completeness of the portal's content and the search function.

The analysis showed that many participants appreciated the opportunity to be involved in the action research study. Their responses indicated that they learned something from participating in this study. For example, some participants who did not attend the Research Training Programmes admitted that the information within the portal that is related to the research training modules was helpful.

Summary of the Action Research Cycle I and II Findings

Research students commonly go through six stages in the research study, namely application, induction, getting on, developing, completing and alumni. The information requirements of research students were found to change as they went through the stages. The changes reflect the tasks that they need to carry out at each stage. For example, at the application stage, a student intending to do a research degree needed to develop a research proposal as part of the application process. Therefore, information regarding how to develop a research proposal was rated as useful.

The development of customisation and personalisation features was recommended. Through customisation, relevant information resources could be automatically presented to users. Furthermore, most participants favoured information resources that are personalised to their interests or needs. For example, a participant from the HASS faculty would prefer to access 'thesis format and structure' tailored to HASS students not general guidelines.

Web usability was found to be one of the major issues discussed during action research cycles one and two. It was suggested that the use of words to name web links should be carefully thought through, as inappropriate words would confuse users. A proper navigation technique or a site map was also recommended to be implemented in the e-learning portal.

Another issue that concerned the participants in these cycles was that of information quality. Currency of the information available on the e-learning portal was argued to be the important point in attracting users to repeat their visits to any web site. Table 29 provides a summary of the issues discussed in action research cycles one and two.

Research Students' Requirements		Issues discussed
Information		
Stages	**Application**	Accommodation, research facilities (laboratory equipment), library resources (full text journal), area of research (academic profiles), university ranking (RAE), procedure of how to apply, tuition fees, living costs, life as a research student, mentoring system, city and its surrounding, student clubs and societies, testimonial quotes and research proposal guidelines.
	Induction	Information for new students (procedure to open a bank account, finding private accommodation, student clubs and societies), rules and regulation of a research degrees, research skills training, personal safety, taught courses modules.
	Getting-on	Application systems related to research skills training (i.e. Blackboard, e-portfolio), research skills training and taught courses modules, funding bodies.
	Developing	Conference alerts, methodology

	Completing	Procedures of submitting a thesis, rules and regulations regarding thesis submission, career options (postdoctoral positions), congregation ceremony.
	Alumni	Previous PhD holders
Functional		
	Personalisation	Personalised content
	Customisation	Relevant content
	Usability	Suitable links' names, site navigation
	Information quality	Current

Table 29 – Summary of issues discussed in action research cycle I and II

Appendix I Action Research Cycle III

The purpose of the interview and focus group discussion in this cycle was not only to corroborate requirements identified during the initial data collection phase (documentation and expert consultation) and action research cycles one and two, but also to identify new requirements. Generally, the information requirements identified in action research cycle three and four echoed what was identified in the initial phase of the study.

The Information Requirements

This section discusses the findings related to information requirements of research students at each stage of the research life cycles.

The Application Stage

Areas of Research

The participants from AR cycle III also expressed their needs toward information related to research areas of academic staff. In addition, medical students expressed the need for information on academic staff research projects. This was because some students were interested in working or basing their research on a Supervisor's research project, as explained by one student from the Medical faculty:

"I just look at different universities for my area of interest, and then I contacted different supervisors for a place in the lab. Usually you can get some information about the projects on the Internet. However, in my case, my supervisor replied and offered me to work on his project".

MED1-Group1

Information relating to the publications of academic staff was also identified as being important in assisting candidates at the application stage. The publications would help prospective research students frame their research proposal before applying to particular university. As one participant said:

"For me, what I did was I used my supervisor's profiles information available on the website and based my research on it. I also referred to some of my supervisor's papers in my proposal to show that I have similar interests to my supervisor".

SAgE2-Group1

Some participants argued that potential supervisors' research interests were one of the main

factors that determined which university to apply to for their research degree. If the academic's research interest matches theirs', they would apply to that university.

Academic Facilities

In terms of information about academic facilities, students identified information concerning accommodation, laboratory equipment, research centres, computing, and library facilities as well as English language support as important areas to be made available through the research portal.

The analysis of the focus groups revealed that international students were more interested in looking for information on the topic of privately rented accommodation than home students. Accommodation information was equally important to both single and married students.

Furthermore, the analysis showed that there are differences in preferences related to the type of accommodation amongst participants. International non-EU and single students were more interested in looking for privately rented accommodation than local or EU students. In addition to privately rented accommodation, international non-EU and married students with children were more interested in knowing the provision of facilities suitable for children near their accommodation.

One participant from the Faculty of HASS suggested that it would be good to have a link to all research centres in the portal, as in the following quote:

"For the research facilities, I think that if you put the centres for research which will link to all the research centres of the university this is quite good. I want to know what research centres are under the linguistics school etc".

HASS5_Group3

When this topic was discussed amongst medical students, they agreed that it would be useful to have information about research centres available through the portal. This was because three participants were attached to particular research centres within the Medical Faculty. It was through the research centres that these participants found their research interest and applied for a place for the research degree.

"I applied through the website. No, but actually no, it was eventually through my supervisor, which I found through browsing the research centres websites".

MED1_Group1

With regards to information about English language support, participants from international backgrounds commented that the information would be helpful to them, as in the following quote:

"For me the main problem is when English is not your first language. Writing academic English in a second language can be very difficult. This is because it is easier to explain in your own language but when you translate it to English, it's no good. So, I think for people with English as their second language, we need support in this area. Information on what language support is available will be useful".

HASS6_Group2

Visa and IELTS

Participants also liked to see some information related to the British council for visa purposes and a link to the International English Language Testing System (IELTS). Other information identified is related to living expenses. One participant argued that an international student who is self-financed would appreciate information on the minimum living expenses per month that he or she needs to cover. This is shown in the following quote:

"As a single student, you need around 600 pound per month, right? However, if you are a sponsored student, you don't have to worry about this. However, if you are self-sponsored, you need to know the life expenses or cost of living".

SAgE1-Group1

Colloquium Activities

Some participants would like to see information related to the kind of academic gathering organised by each school within the case university. This is illustrated in the following quote:

"In the Business School itself, we have a business school researchers' forum, so that could be something interesting in seeing who's there, their research and community".

HASS1-Group3

University Rating

Issues on university rating were discovered again in the later action research cycles. Participants felt that university ratings played an important role in determining their decision to study at particular institutions. As one student from the faculty of SAgE claimed:

"For me I looked at the grade, the Research Assessment Exercise".

SAgE2-Group2

Proposal Guidelines

The need for proposal guidelines varied amongst participants. Most participants from the HASS faculty commented that a template or structure for a research proposal should be available to prospective students as a guide to write their proposal for applying to university.

"I think it will be very useful for research students like us, because we don't have any guideline or some kind like template on how are we going to prepare the proposal because different universities have different kind of ways to write the proposal. So I think if they just can make it into a standard template, it would be better".

HASS3_Group1

Some participants also claimed that sample proposals would help them in the process of writing their own proposal. When further analysis was conducted, it showed that participants who entered the research degree right after they graduated from their bachelor degree were mostly concern about having a sample proposal.

The Induction Stage

The information resources related to support activities during the undertaking of research study are described according to the four stages of research study of typical research students. As in the former action research cycles, the four stages are induction, getting-on, developing and completing. Once students are registered, they will go through an induction programmes, provided by the schools, faculties or both, taking some modules from the research training programme in their first year while developing their research proposal. Then they move on to the next stage after having done an annual progression assessment. During the developing stage, research students are developing their methodology and at the same time take some modules from the research training programme. They also conduct their data collection and analysis in the developing stage. Finally, during the completing stage, research students write their theses, prepare for thesis submission and a viva.

Overall, information related to the induction stage was identified through the analysis of research degree documents and four action research cycles. Generally, the empirical data confirmed the findings from the analysis of documents and earlier action research cycles with

regard to the information needed during the induction stage. The information requirements identified for the induction stage can be categorised into the following themes: information on settling down (for example, accommodation, health, food, and social activities), information on library skills, information related to the research process, rules and regulations (handbook), and other information (building locations – maps, contact people etc.).

How to Settle Down

The information on how to settle down was identified as the most important information for new students. One participant argued that everything started from home, as in the following quote:

"From my experience, when I came to do my master, the first thing I did was to settle down, so I needed to know how to survive here, about the accommodation, transportation, all the domestics and logistic stuff basically. Because everything started from home, when you are not happy at home, how can you start your research?"

HASS1_Group1

Participants identified information related to accommodation, health, and social activities as important information for them. some participants admitted that they got an information pack before they came to Newcastle; however only few had read the information, as in the following quote:

"Yeah, I remembered that I received an information pack before I came, but had no time to read it. I guess I should have read it".

SAGE3_Group2

Some participants claimed that they obtained information about registering with a GP practice from their friends, who had lived in the City for several years:

"Actually, when I came, I stayed with my friends for two weeks before I moved to my flat. So she explained everything to me, how to open an account, how to register with a GP, how to do direct debit and everything".

HASS4_Group3

In addition to health information, Muslim participants were particularly pleased to find a link to information on places for Halal food stores. One participant commented on this matter:

"I'm in the second year but only now saw this information for new students, they cover even the places for 'Halal' food … May be the information was there all the time, but I knew it only now. Sometimes there are other

important things when you are new to a city, for example, because I come from a Muslim background, this is important for me".

HASS5_Group2

Views on the importance of information relating to student clubs and societies varied amongst the participants. Of the 35 participants, 12 stated that they valued information on student clubs and societies within the portal; one commented that the information was not relevant to him, whilst others did not discuss it further. The following quotes show two different views on the availability of clubs and societies:

"What about the student union or club and society, because I think this would be of interest to all of the students to know what kind of things they can do to support their social life, especially international students who come here and want to be a part of the society".

HASS5_group3

Library Skills

Library information skills, such as how to use the library effectively, how to search databases and journals, and how to evaluate the information on the websites were identified as one of the important information during the induction stage. The following quote shows this point:

"Another important thing for the literature review is access to the databases. You need to know what databases are available for your specific field in the university library. The Athens[1] thing, you need to know your Athens account before you can access any databases, so knowing how to create an Athens account is critical to new students".

HASS1_group2

The participants also commented that library skills were important when they wanted to conduct the literature review:

"I think we need library search skills to help in our literature review process. We need information on available databases and the method of accessing them, accessing the electronic journals as well".

HASS3_Group2

How to do a Research

Besides the information provided in the portal, participants also identified other information that they thought would support them during their induction. Some first year participants

[1] The reference to Athens was made when the system was still in used. However, the use of the Athens account for the purpose of databases access was discontinued last year.

recommended that there should be some basic information on how to start doing research. This was due to the fact that some first year students undertook the research degree straight after they finished their bachelor degree, and thus they thought that they did not have enough experience in doing research. One participant commented this:

"PhD students are going to be younger and younger, they always finish their masters or first degree and go straight to PhD, and they don't have any experience at all. So like last year, we attended the class, you got picture of what you want to do and next year you don't have any picture, it just your supervisor, to support you on what you do in the next one whole year so you don't have anything to control you, it is so complicated…"

HASS3-Group1

Facilities and support

As for the handbook for research students and research supervisors, analysis shows that participants were concerned with detailed information within the handbook. The issue here was that information provided within the handbook seemed too general. The participants were hoping that the schools gave more detailed information, particularly on funding for conferences and entitlement to resources.

Contact Person

Some participants believed that information regarding the contact person responsible for the research study should be available on the portal. A second year student commented that she had no idea of who to contact when she was having some problems with her study. The majority of the participants who did not attended the Faculty or School induction session stated that they did not have this information.

"Actually, I was thinking about it now, I agree with her. You have to know who is dealing with what in your school or faculty, exactly as you said when you are having a problem, you need to know who to see or talk to. When I was in my first year, I don't know who to turn to when I have a problem. So, I think it is important that we have these contact details in the portal".

HASS5_Group5

The analysis showed that students who missed either school or faculty induction programmes had a very limited idea about the policy of the school – for example their entitlement to research resources such as conference funding and the accommodation within the school. The reason for missing the induction varied from late registration to odd semester registration. When asked, the majority of participants believed that they learned something new during the conduct of the focus group. In addition, by participating in the focus groups and using the

portal helped them in terms of clarifying things that they didn't know before. The analysis also shows that the portal is one of the methods that could support students who missed the induction and as a reference place that provided information relevant to research degree students.

The Getting on Stage

The getting on stage is the stage where students will be undertaking research training modules and at the same time developing their research proposal. This section describes the information identified as needed to support those activities within this stage of research.

The information needs identified for the getting on stage can be categorised into the following themes: information related to managing a research degree (managing supervisors, time management and the research degree process), developing the research proposal (research questions, guidelines, format/structure/sample, methodology, literature review, and sample theses), annual progression and writing materials.

Managing a Research Degree

Information relating to managing a research degree was identified as one of the most critical information requirements during the first year of research students' life cycle. Participants identified information concerning managing supervisor relationship, project management and time management as being critical to managing their research degree. The majority of the participants argued that the first thing that they needed was information about managing their supervisor:

"First, I think we need information on how to build a good relationship with our supervisors, what the supervisors' role is and what are their expectations of us. I think we need to know this information if we ever want to succeed".

HASS1_Group1

Participants also commented that they needed general guidelines on specific things that they could discuss with their supervisor:

"I think we need general guidelines on what students should discuss with their supervisors, how to build professional relationship, something like that".

HASS2_Group2

The hyperlink to 'time management' articles received varying feedback from participants. The majority of participants believed that the article gave them an idea about the importance and process of managing their time; however; one participant in particular did not see the importance of the article. When asked for his reasons, he stated that time management is a skill and that you learn managing your time by practice, not by reading the materials. However, he agreed that the information could be used to generate an awareness of the importance of time management:

"Yeah, time management is important, but you need to be consistent in whatever you do, then it will work".

HASS5_Group3

"Well it depends; in my research, the most important thing is to get results. Even if you do manage your time effectively and don't get the results that you expect, it will prolong the duration of your study".

SAgE1_Group1

Developing Research Proposal

Besides attending research training modules, research students develop their research proposal during the first year of their study. Information identified as essential in supporting the development of research proposal included structure or format as well as a sample proposal including the formulation of research questions.

The need for a format for a research proposal was mentioned by the majority of the first year participants. The majority of participants from the HASS Faculty commented that they relied on general format, whilst participants from the SAgE and Medical Science Faculties argued that their schools provided guidelines on how to develop their proposal. The HASS participants also commented that it would be helpful to have a link to a guideline on the format of the PhD proposal within the portal.

"If I remember correctly, in the [school name] school, we do not have a standardise format for a research proposal. We just refer to the general format available via the Internet or library".

HASS3_Group2

"The resources on how to write the proposal, in terms of our case, the school gives us guidelines on what to include in a research proposal. This is because at the end of the first year, we have to submit our proposal for annual progression and we have to make a presentation as well. The school also provides presentation guidelines".

SAgE1_Group1

"I think the guidelines for a proposal were written in the website, and they actually tell you what to write: this includes introduction, materials, and methods, future work and everything".

MED3_Group1

The formulation of research questions was identified as the most difficult task at this stage. First year participants from the Faculty of HASS particularly commented that they would value information on how to formulate research questions.

"For the research proposal, I think the main thing is the research questions. How to formulate or find out about the gaps and problems within, I think there should be a guidelines on how to develop research problems. This is because they are the centre of your proposal".

HASS4_Group1

Other participants however, associated research questions with the period taken to finish his or her research proposal; in particular, if students were clear on their research questions, they would take a shorter time to finish the proposal:

"This is the main issue here (referring to the formulation of research questions), if you came without research problems, you have to stay longer, to discover research problems first before you can start a literature review".

SAgE4_Group2

When a link relating to the formulation of research problems within the portal was shown to them, they commented that information would be helpful if they had known earlier.

"This is useful; I wish I had access to this information before".

HASS1_Group1

Literature Review Materials

Research students need to write a literature review as part of their research proposal. The analysis of the transcripts showed that participants identified information regarding guidelines, access to databases, sample literature reviews and sample theses as important information to support their literature review process.

With regards to guideline on literature review, the majority of participants commented that more help was needed to support the literature review process:

"Again, we need guidelines on how to do the literature review. This is because the literature review is a required part of a research proposal, you can continue forever so you need guidelines that can guide you in the sort of literature review in a doctoral research that you need".

HASS5_Group1

In addition to guidelines, participants also mentioned that they needed a sample literature review:

"I think may be samples of literature review are a good idea to have a look at".

HASS4_Group1

The participants also commented that they needed sample theses to know the level or standard that they had to achieve in their literature review writing:

"I think one thing that I did was to look at literature review and methodology sections in a thesis. There are resources in the library; you can look at pass PhD theses, it can help you to see the structure of literature review … it gives you an understanding of where your work or what level of your work should be …importantly I was told to read four theses …"

HASS2_Group3

Participants from the three faculties commented that access to e-journals or online databases were critical in conducting the literature review. The more critical information to have was information regarding the library skills. The following quote represent this view:

"… e-journals are very important …"

MED1_Group1

"You will need information about how to access e-journals, how to access online databases".

HASS3_Group2

"In my research, I used Compendex database the most. I think having library skills is essential".

SAgE1_Group2

Annual Progression

The annual progression assessment is critical, particularly for first year students. When discussing this topic, the participants identified different types of information requirement and a need to understand the criteria for assessment.

The analysis found that participants discussed their needs based on their experience of having gone through the assessment process before. However, first year participants (who were just registered) asked questions to clarify things and at the same time, learned from other students' experience. The analysis also showed that each school had different process for annual assessment; however, essential progression forms were the same across the faculties. Participants from the SAgE and Medical Faculty argued that they have a variation of presentations, reports and mini viva for their annual assessment process. However,

participants from the HASS Faculty stated that in addition to progression forms, they needed to produce an annual report for the purpose of annual assessment.

"Based on my experience, we need to submit some forms, mostly the forms in the Personal Development Plan (PDP) … the e-Portfolio thing and a report…"

HASS1_Group3

"Yes, for me it is a report which basically consists of introduction, literature review, materials and methods, results if you have, future works, problems you encounter so far. Then after producing that written report of about 7500 words, some of the schools require a presentation, but mine was a viva, something like a mini viva, so they asked you questions on what you have done."

MED1_Group

The analysis showed that majority of participants across the three faculties was unclear of the criteria that the schools used to evaluate the annual assessment. Therefore, they expressed the need for more explicit criteria for evaluating their research degree progression.

"Well for me, I needed to know the criteria for evaluation, what we were evaluated in the work".

HASS4_Group3

Writing Materials

Other information identified as necessary during this stage was related to writing materials. The writing materials identified included information on bibliographic software such as EndNote, English language support, and academic writing tips:

"You need instructions to help you use EndNote".

HASS3_Group3

To support their writing, participants particularly European and International students identified English language resources as important to them. The majority of participants agreed that a link to the English Language Centre was helpful.

"After I finished writing, I think it is a very good idea to consult with the English consultant at the writing centre. This is because English is my second language, sometimes it is not only about grammar but it is about the use of certain words. We need to know which words are common in academic writing".

HASS1_Group3

Participants also suggested having a link to the English Language Materials Online (ELMO) website within the portal. This is shown in the following discussion:

"I don't think I saw something about English like a link to ELMO or English courses …"

SAgE1_Group2

"Yes, there is nothing here …"

SAgE4_Group2

"I think a link to English courses is quite important, especially for students who are just starting their research".

SAgE1_Group2

Various writing tips websites were suggested by participants when evaluating the portal. Two participants recommended a link to the 'Academic Phrasebank' website, four recommended the 'Academic Word List' website and five recommended the 'Reference for Collocation' website. The 'Academic Phrasebank' website contains common phrases used in academic writing, and was developed by the University of Manchester. The 'Academic Word List' website contains lists of common words used in academic writing and the 'Reference for Collocation' website is a British National Corpus developed by a Professor from the Brigham Young University.

The Developing Stage

During this stage, research students are developing their methodology. The analysis of the focus groups revealed that information related to research methodology, career development, conferences, annual assessment, presentation skills and report writing were identified as needed to support research students in carrying out their research activities.

Some of participants commented that their research needed access to secondary data from inside as well as outside of the case University. In this case, participants commented that they needed to know to what extend research students could access secondary data. A general guideline was identified as useful to international students particularly. This is because international students were not familiar with the rules and regulations in this country:

"You need to know what right you have towards access to secondary data from public or private companies. For example, the information on to what extent you can access public data or data available from government institutions. This is especially important for overseas students because they come from a different system. So, I think it is important to give guidelines about these points to students' right from the beginning".

HASS5_Group1

When shown the link to research methodology reading lists, the majority of participants thought that the list was useful:

"This is really good, especially when I clicked on the research methods link, it give you all the resources that we need to read, this is really helpful".

HASS3_Group1

Career Development

Career development information was viewed as important during the second year of research study. The majority of participants claimed that during this stage, they were more interested in information relating to part time jobs and industrial attachments rather than information on future careers. The information resources could include teaching or demonstrating and industrial attachment opportunities, and other part time jobs.

"I would be interested to do some teaching within the University. Yes, I think that probably would be more of my focus. What I will be exploring or trying to find out if there is any opportunity to go to France or Germany. But, that is how I see it now".

HASS1_I

"I think it may be useful to have a link to the students' union, especially a link to the 'job shop'. So that student can find job vacancies or may be students can find their part time jobs. May be the students want to know what kind of jobs is available within or outside of the university. It will be very useful".

HASS4_Group2

Participants from the Medical Faculty suggested a website that offers industrial attachment experience to be included in the portal. The site called 'Biotechnology Yes!' was incorporated into the final prototype portal.

Conference Information

Participants commented that during this stage they would be also looking for information relating to conferences. Participants suggested that a list of conference alerts could be incorporated within the research portal:

"You need to know about what conferences in your field …"

HASS1_Group1

"Actually, there are sites that list several different conferences topics and they updated the list regularly. That could be useful …"

HASS1_Group2

Presentation Skills

With regard to attending conferences, participants noted that presentation skills resources would be useful during this stage as well. The analysis showed that both oral and poster presentation resources were needed at different times, based on the students' research. For the HASS faculty students, they were strongly advised to give an oral presentation at the end of their first year and a poster presentation at the end of their second year. Thus, oral presentation materials would be ideal if provided during the first year, and poster presentation resources would be ideal if provided during the second year:

"We took a presentation skills workshop during our first year because we needed to present at the HASS postgraduate conference in May. We are supposed to take a poster presentation workshop in the second year".

HASS6_Group2

Links to presentation skill resources received good feedback from the participants.

"The presentation links are very good as well. This information you would need when you are in your second or third year. You need to go to conferences; you need to present you findings, so such information is quite useful because they are generic as well easy to understand".

HASS5_Group3

However, as discussed in the section below, the participants argued that it would be more useful if the content was tailored or developed by the case University.

The Completing Stage

Information resources identified as important during this stage were thesis submission, preparing for a viva and career planning (job within academia as well as in companies).

Thesis Submission

In addition to resources on handling large documents, the analysis indicated that information related to the publication of work within the thesis was critical. Participants suggested that a general thesis format and structure should be provided by the case university. Currently, the portal provided a link to a general thesis format and structure developed by one of the schools within the Faculty of SAgE. However, the majority of participants commented that the resources on thesis format should be more specific to their research area. In addition to thesis format and structure, the participants also identified the information on thesis presentation format as essential in the process of producing the thesis.

"I think you need to know the structure or the format of the thesis …"

HASS5_Group2

"The thesis format is from Engineering, not from my school, so I think it would be more useful if I can have the format from my school here - tailored more to my needs".

HASS2_Group1

Preparing for a Viva

Information about preparing for a viva was also identified as essential for second or third year students. Some participants suggested that previous students experience this as a helpful guidance if available through the portal.

"For me, I want to listen to direct experiences from graduate who have just finished their viva. They could describe their experience including the questions that they had".

HASS1_Group3

"Yeah, I think everyone needs information about viva and stuff, how to prepare for the viva and may be how to overcome the difficulty of the task".

HASS2_Group3

Career Planning

Other information identified as important during this stage were information resources relating to future careers. In addition to commenting on the existing links, participants also suggested other links to a recruitment website specialist in the careers in academic, research, and science.

"I would suggest that you make a link to this website 'jobs.ac.uk'. I have used it for quite some times and I found that it was quite good".

HASS1_Group1

The Alumni Stage

With regards to the alumni stage, participants identified information regarding library and computing services as important. They would want to know the kind of library and computing services would be available to them after they leave the case University.

"I would want to know whether I could still use the library services after I leave.
How about our university e-mail? How long can we keep them?"

HASS4_Group2

The Functional Requirements: Features and Functions

The features identified by action research cycles are categorised into four types: integration, personalisation, customisation and user interface features. Some of the identified features were implemented and some were not implemented in the final prototype portal due to a lack of resources.

Integration

A portal aims to provide a seamless, web-based interface to a range of university systems and services. Stanley (2007) claimed that the key benefit of a portal framework is to bring together different resources and systems into a single environment. These systems can be utilised by end-users in an integrated fashion, thus aiding efficiency and effectiveness, and improving the overall user experience (Stanley, 2007).

The case University had three independent systems that supported research degree students. These systems included e-portfolio, Blackboard and e-booking. Their descriptions have been given in section 5.1.1 and thus, will not be repeated here. Currently, the prototype portal only provided simple hyperlinks to all of these systems. Therefore, if users wished to use the systems, they needed to re-login (enter their username and password) to all except the e-booking system once they follow the hyperlinks within the portal. With regards to this situation, the majority of participants expressed the desire for a single sign-on.

"I'm concern with log-in, too many times to log-in. If possible, integrate all systems in the portal".

SAgE1_Group1

In addition to providing one log-in, the analysis showed that the majority of participants were concerned about the separate systems they have to use to support their tasks. For example, for information related to research training modules, in addition to consulting the Blackboard system, they also got e-mail notifications. The participants expressed the need for an integrated system where they can find everything in one place.

"I think the portal is very helpful and cost effective in terms of saving time. I think it is good to have only one portal to help students rather that separate systems. Now we have Blackboard and email where we received notification about our research training modules. However, if we can only refer to only one place for everything, that would be wonderful".

HASS2_Group2

The integration of relevant systems should be seamless where application systems can share information between them. For example, users should be able to view details such as the description of the module, credit hours and training dates that they register through the portal.

"It will be helpful if I can log in here and see what (research training) modules I'm studying. I can access all kind of materials from the modules, so this can be my own space I use for any of university activities or training or anything but you wouldn't be able to have access to individual materials".

HASS5_Group3

Personalisation

Personalisation within the portal was achieved by providing users with a user-defined RSS and bookmark functions. Currently, the portal allows users to define their own RSS feeds and to manage their favourite links within a bookmark facility. The RSS feeds feature supports the dynamic information needs of the users, such as the need to get an updated table of content of a journal or news related to their research area. Users can personalise their portal page by choosing their favourite RSS feeds. The RSS feature was perceived as useful based on positive comments from the majority of participants. However, they expressed the need to be able to determine the number of RSS feeds that they wanted to display in their page:

"You have four RSS feeds here, what if I want to have six RSS feeds. Can you change it so that I can choose how many RSS feeds I want? Yeah, it would be really helpful if you can make it more flexible to remove or add the RSS feeds".

SAgE1_Group3

In addition to the ability to personalise the portal page by adding their favourite RSS feeds, users can also manage their own bookmarks. The majority of participants provided positive feedback on this feature; however, they would have liked to be able to determine the number of bookmark boxes that they could have:

"Can you give an option to users so that they can choose the number of boxes they want for their bookmark? I think you can do it like the preference for 'year of study', where users can choose what year they want to view".

SAgE1_Group1

Based on this feedback, the portal was updated and the final prototype allowed users to choose the number of RSS and bookmark boxes they wanted to display on the portal.

Personalised Content

With regard to personalised content, two issues emerged from the analysis of focus group transcripts. Analysis showed that participants required content to be personalised to their needs. This was shown in the feedback given by participants on various content pages within the portal, such as the funding resources, presentation skills and thesis structure pages.

In addition, the majority of participants expressed the desire for content that is tailored to specific audience. The link to thesis structure was provided by the School of Chemical Engineering. Of particular interest to them were the structure and format of the research proposal and thesis. The following comments from participants from Humanities and Sciences faculty illustrated the point:

"What I found here (content within the portal) is not prepared for the school related to my research. So, I think it would be more useful if you can include the content tailored to my needs. For example, here the proposal format required by my school".

HASS2_Group1

"Our school already has the proposal format that we need to follow so, it would be good if we can access the format through this portal. It would save time. Instead of looking at other places, I can just log-in to this portal to find everything related to me".

SAgE1_Group1

Personalised Announcement/Reminder

The analysis also indicated that the participants expressed a need for some kind of personalised reminder service:

"I think it would be helpful if you get some sort of announcement service about research training seminars, conference or workshops offered by schools, university, or external organisation".

HASS5_Group1

"If you have a reminder system, you will be well informed of what you are expected to demonstrate or to submit and by what date …"

HASS3_Group1

"I think it would be useful to have some kind of a notification system about your annual assessment. Let say that in June you have to submit your assessment documents, so a month before that you would get a flashing red banner stating, "You are one month away from your annual assessment".

SAgE1_Group2

Customisation

The way that the research portal implements its customisation is through prompting users to input information. The portal asks users to choose their school, faculty, year of study, the number of RSS feeds and the number of bookmark boxes from a drop down list. Based on the information given, the portal tabulates relevant content for users. With regard to this type of customisation feature, the analysis indicates that the majority of participants liked the idea of inputting their details; however, a small number of participants believed that it would be more convenient if the portal could access existing student databases and retrieve information about users without prompting them to input the details. As one participant commented:

"I think it would be easier if you can get our detailed information from the log in data. What I meant was that once I logged in, the portal can access my detailed information from somewhere, the student profiles for instance. That way, we do not need to key in the input in the 'your preference' column".

SAgE1_Group1

However, for the purposes of this research, this type of customisation was not implemented, for two reasons. The first was related to privacy issues. During the early implementation of the portal framework, the web team who were responsible for implementing the framework were not allowed to access the student database because there were restrictions due to privacy issues. Moreover, the purpose of the prototype portal was only to test the portal's concept, not to focus on implementation issues.

Second, the customisation feature was not an enforced feature. In addition to presenting content relevant to users' preferences, the portal also allows users to choose the content that they wish to view. For example, users from the Faculty of HASS could choose to view research training modules provided by the Faculty of SAgE or Medicine if they wished to do so. All they had to do was to change their faculty's preference. With regard to this feature, the participants valued the opportunity of choosing content that was not directly from their faculty.

"If a Business student can also read about what is offered to Computing students, this is good actually. This is because may be she wants to know about modules offered by other faculties".

SAgE3_Group1

In terms of the customisation feature that changes the order of the tab when users input the year of study, the analysis of the focus group transcripts indicated that this customisation feature confused the users. The following quotes demonstrate this issue:

"When you changed the 'year of study' preference to 'year 3', the portal still displays the 'developing' tab. The order of the tabs is different but the content in each tab is still the same. So it confused me. But after your explanation, I can understand".

SAgE1_Group1

"I want to suggest, I think you should make a different from the other tab, because when people change the year of study, they will notify that the order of the tabs is also changing. I mean in terms of colour".

HASS3_Group1

User Interface

The user interface of the portal received both positive and negative feedback from the participants. Participants mostly commented on the colour of the interface. Almost half of the participants commented that the colour of the interface was too plain. They would like to be able to change it according to their preferences.

Colour

Besides personalised content, the participants also expressed the need to personalise the colour of the portal's interface. One participant remarked:

"Can I customise my page? Can I choose the colours that I want? I would like a colourful interface, more interesting if you like".

MED3_Group1

Interactivity

Participants also commented on the portal's lack of interactivity. They compared the portal to other commercial portal such as 'I Google' and 'My Yahoo' where users could drag and drop channels or application systems as they wished.

"I think, what would make this portal interesting is to add a little interactivity to it. You can check iGoogle, how easy it is to add and delete things".

HASS4_Group3

The interactivity should be considered by developers if they want their portal to meet the requirements of research students.

Security

Security was found to be a concern of the majority of participants. As the portal currently does not have a log out function, this made participants uncertain about its security:

"For me, security is really important. I don't want anybody else to have access to my data. So if I want to leave the portal, I want to be able to log out completely. How can I do that?"

HASS2_Group1

One participant suggested having a log out feature.

"I noticed that you don't have a log out function. Can you add this function?"

HASS3_Group3

However, the implementation of the log out function lay outside of this research project, due to resource constraints.

Appendix J Action Research Cycle IV

This appendix discusses the finding of action research cycle four in terms of information requirements and evaluation of the portal.

Information Requirements:

The Application Stage

Information about research area and academic staff research profile

Information regarding research area was considered as one of the most important issues for prospective research students when they were considering their study options. As one student from the DBA programme explained:

"I think if you have a section on the website where lecturers can deposit their research interest; this will be of value to prospective students".

DBA2-Group2

As matching their interest with academic staff was important to participants, they considered information about the research interests of academic staff to be critically important for the portal. One DBA student pointed out that he would not get good supervision unless there was a match between his and his prospective supervisor's research interests, as illustrated in the following quote:

"When I changed my area of research, and the reason why I changed the school is because in the previous school I was, there was no expertise in Technology Management. Therefore, you cannot expect to get a good supervision if there is no area of interest in the research you are interested in".

DBA1-Group1

Academic Facilities

Information about library and computing facilities, as well as English language support was also identified as important to prospective students. With regard to library facilities, the findings from the third cycle were similar to the findings from the first and second cycles. Participants commented that they were more interested in knowing the kind of full text journals, either electronic or non-electronic that the library subscribed to.

"I want to know about online journals, what are the journals that the library subscribes to. Just to assure students that the library subscribed to e-journals such as Science Direct or Swetswise. If the library doesn't have

the papers that I need, what should I do? I think this kind of thing would be really useful to know before you apply".

MED1_I

Participants claimed that information on computing facilities should also be available to prospective students. In particular, one participant commented that the information on the helpline numbers would be useful to know before coming to Newcastle.

"But just to know basic helpline number is good. Thinking about that, I know that when I came, this was what I had to try and search for, initially trying to find, I mean I went around several buildings to find the ISS support because I had just a couple of basic problems with the system. So if you know it before hand, to be able to get help or you got the number then, it is just, well, one less thing to think about when you get here isn't it?"

HASS1_I

It is interesting to note that two participants suggested that the portal should provide information about local newspapers published in the area. They argued that prospective students could get a clearer picture on what to expect about the surrounding area. A participant from HASS illustrated this idea by saying:

"When I was a student in France, I mean I was working in France and worked just a couple of week at the university, that is (the newspaper) the kind of information that I wanted to know. I learned bit by bit which is really good to have beforehand. Look out for this, this is how you get the local news; improve yourself in English. I think that is very important from the international perspective".

HASS1-I

Tuition Fees

The findings relating to tuition fees from the first two action research cycles were echoed in the last action research cycle's findings. This finding demonstrates that tuition fees information is important to prospective students.

A number of participants claimed that the tuition fees played an important role in deciding which institutions they want to study for their research degree. From the analysis, it was found that participants with sponsorship perceived tuition fees as not being important, whilst self-funded or partly funded students perceived the availability of tuition fees information to be important. Thus, they needed the information about the tuition fees for each research degrees course. Examples of quotes that demonstrate this need are as follows:

"I need some information about fees".

DBA2_Group1.

"Yeah, information about fees will be helpful".

DBA1_Group2

Students Testimonial

Student testimonials played an important role in determining which institutions people applied to. However, participants also expressed their disappointment, pointing out that most of the testimonials cited the good things about living at a particular place. Two participants in particular liked to hear about all the benefits, as well as the disadvantages of living at a particular place.

"I was going to say that what I really want, is to know someone who is been doing my subject and just to say a little bit about what is their experiences. In the sense, I think, I mean I know it has got to be official because it is going to be on the Newcastle University website but I don't want it to be all like "oh this is all brilliant, brilliant, and brilliant". I want some kind of honesty, it is like "this was hard but I had support in these", "this is been really great", "I found this part is difficult, initially adapting was hard but the university helps me in this way".

HASS1_I

"Oh, the quotes are only telling the good things. I'm quite experienced in the things that people put on websites, so what you put here will not affect me. I would be more interested in fair quotes, telling people about the good as well as the bad things that they experienced".

MED1_I

The Induction Stage

Location of Academic Buildings and Libraries

Other information identified as critical to new students related to the location of academic units on the campus. The first year participants particularly, commented that information on the location and its associated building of the academic units and libraries was important for them to get around the campus. One participant commented as follows:

"Yeah, absolutely, it would be helpful to know more specific about location, especially a few schools within a building. I think it will be confusing now because the Business School is located at three different places. I mean and even the Ridley building, it houses Biology School as well. And, I've been to the wrong building for a time for an appointment because they are both called Ridley building; you're not sure which one".

HASS1_I

The Getting On Stage

Project Management tool

One participant from the Medical Faculty suggested that incorporating some kind of project management tool within the portal to support in planning their research project would be helpful:

"I think information like planning your PhD because in your second year, you have got idea where your PhD is going, how you are going to finish it in the last year. And planning for that I think is quite good if you can use something like a project management tool to learn more about time management".

MED3_I

Project management software was not incorporated in the final prototype for several reasons. First, the scope of this research was only to identify the requirements of an e-learning portal. Second, at the time of study, suitable and open-source time management tools were not available. Thus, it was not incorporated in the final prototype. However, links to various websites that provide resources about project management tools were incorporated within the final prototype portal.

Sample Proposal

The participants also expressed interest in sample proposals. The samples would help them in structuring their own proposal, as one participant said:

"I need to have a hold on a sample of research proposals. I'm a visual person, so I need the sample proposal so that I can visualise my proposal structure. When I developed my proposal, I referenced a couple of proposals in my area and it really helped me. So a link to sample proposals would be helpful to beginners, I think".

DBA3_Group1

The Developing Stage

Research Methodology

Information relating to research methods was identified as important to research students at this stage as they would be conducting their fieldwork. Amongst the information identified as important was information on software for data analysis and access to secondary data.

"I think we need software to support research. I mean it can be the analysis software that helps you transcribe, I mean all the software tools that may be relevant for research. Information on where you can find them, their price, their strengths and weaknesses of the different software would be something very useful".

DBA2_Group1

"You can also add different kind of methods, quantitative and qualitative. What are the different methods in general and general description for each method? Even if you know them already, it is good to have references that you can visit anytime you want to refresh your memory".

DBA3_Group1

Presentation Skills

The need for both oral and poster presentation among the medical sciences participants was varied depending on their research. Some participants reported that they needed both presentation skills resources during their first year, whilst others reported that they only needed poster presentation resources during the first year.

"I think it is up to the students, if during the first year, you already have good results then may be it is a good starting point for you to just involve with the poster presentation … If you want to involve with oral presentation, it would better to do it in the second year".

MED2_I

"Yeah, we do have presentation every year for the assessment thing; in fact, we also have presentation like every two weeks because we got sort of a department meeting. We have four students in a group and one or two people present at the meeting. It goes like a rota so it kind of may be I have to present only once a month".

MED3_I

The Completing Stage

Handling Large Document

During the completing stage, research students are writing up the thesis. The information resource identified as particularly important was how to manage large documents. The analysis showed that the resources on handling large documents received favourable feedback from most of the third year participants. Of eight third year participants, five said that they would benefit from the tips and advice given from the resource.

"I need this document (referring to the 'handling large document' resource) because I will be writing up my thesis soon. The information is really good".

DBA1_Group2

Submission Guidelines

In addition to the needs for the thesis format identified in the previous action research cycle, participants also identified guidelines on the procedure involved in producing the thesis as essential information for students in the completion stage. The analysis showed that some participants were not aware of the submission procedure in terms of the forms that they needed to fill in prior to the submission of the thesis.

"I think we need things like forms that you need to fill in to submit your thesis. You could have an explanation of the steps that you need to take to submit your thesis, like at what point you need to have done this or that. Well things like External Examiner, you should find them few months before and to understand the tips … just so you know at what time you should be thinking about certain things, so you can submit on time. This is because things like that, they don't really tell you how long things are going to take so you need to prepare early".

MED3_I

In addition to information about postdoctoral opportunities and career within academia, the analysis indicated that participants were also interested in career outside academia. One participant in particular suggested that a link to websites that provide information on finding jobs in companies or industries should be included within the portal.

"Do you have a link to industry as well, may be industrial companies that you can link? … I don't know you got to find the resources to learn about finding jobs in the industries. May be you can link to websites that listed jobs within the companies for your future career. I know you got a link to postdoctoral work here. But you could also find a job in companies, like Glaxo Smith Kline, this is a chemical company".

MED3_I

The summarised version of the final list of information requirements after the action research cycles is presented in Appendix O.

The Functional Requirements: Features and Functions

The needs for a single sign-on feature echoed in the fourth action research cycle. However, views on single sign-on varied amongst participants. The majority of them preferred to login only once. However, some participants did not mind logging in again as long as they could use the same username and password. The reason given for this was that by having to log in, users would feel that they were given value for money, as in the following quote:

"Well, it would be better to have one login, but as long as it is the same username and password, it is not too bad … There is still a lot of information in one place. I guess a part of you just think; 'oh, well it is just for student' so psychologically I think it means that you know that it is not open to everyone. So in a kind of weird way it suggests value for money, you are paying your tuition fees, and you know this is the service that they provided, psychologically by having to enter details means that you think 'oh yeah, this is value for money".

HASS1_I

Research Portal Integration with Other Tools

Participants in the action research cycle four also expressed their desire for integration of the

research portal with other systems such as e-mail, calendar, and document sharing and project management tools.

"You can put all your stuff here, right, but if you can somehow get into your email in this section. You can have everything you need in one page …"

"… The things that could be added to this portal, I guess to my degree are the calendar, time management and email … I think it is good to have a time plan …"

MED3_I

Customisation

With regard to the customisation of news and events from faculties and schools, mixed reactions were received from the participants. The majority of full-time participants liked the idea of having the latest news or events about their faculty and school:

"I think you definitely need it from the school. I mean the thing is actually good to have there, because then you can just look down it quickly and I think most of us probably miss most of what's going on at the school because we just don't bother to check. … So I think yeah it is a good idea to have it here, especially as it is in summary form".

HASS1_I

However, the majority of the part-time participants disliked it. Among the reasons for their dislike were:

"Usually for us, not being resident in Newcastle, the news or events are not really important, because we do not live here … attending the event means that we need to book a plane and I mean, I will not come here just for the event, unless the event is specifically tailored for us just like these workshops".

DBA2_Group1

Evaluation of Portal:

As the evaluation of the portal was conducted together with the assessment of user needs, this section presents the analysis of the results found during the conduct of the action research cycle. The purpose of the portal evaluation at this stage was to determine the applicability and value of the portal's concept of providing support throughout the life cycle of research students. The evaluation was based on two criteria: the relevance of the portal's content and features; and the usefulness and usability of the portal. Since the portal was developed with limited capabilities and the evaluation was conducted based on available features, caution has been taken in interpreting empirical data. Analysis highlighted a number of broad issues,

mainly the perceived benefits of the portal, the roles of the portal and the satisfaction towards the content and functionalities of the portal. The results are presented according to the following themes: content of the portal; perceived benefits; usability issues and other findings.

Content of the Portal

In general, participants were very positive about the research portal and generated a lot of suggestions on how to enhance the functionalities of the prototype portal. This section discusses the research students' feedback regarding the content of the portal. Several issues concerning the content of the portal arose from the analysis of the focus groups and interviews. The following sections discuss these issues in detail.

Relevance of Content (The links were relevant to each stage)

As discussed in Appendix P the content of the portal was organised to include hyperlinks to resources identified as relevant to different stages of the research degree process. The analysis of the findings showed that the majority of participants perceived that the content of the portal met their expectations. Participants made comments at various points to reflect their perception of the relevance of resources within the portal. The following comments illustrate this point:

i. The relevance of material within the 'Applicant' tab

> *"I think the information provided here (refer to the Applicant tab) meet the requirements".*
>
> MED2_I

ii. The relevance of material within the 'Induction' tab

> *"…to have everything in one place that is really useful…"*
>
> HASS1_I

iii. The relevance of material within the 'Developing' tab

> *"I'm not sure because seem like we have presentation once in a while, every few months we need to present our data to the supervisor and to our colleagues so I think it will be good to be included part as a link in year 1".*
>
> MED1_I

iv. The relevance of material within the 'Completing' tab

"I need this document ('how to handle large document'). This is really good …
I'm almost at the end of my study but the pages that you showed me about the third year students, that information is very valuable".

DBA2_Group2

Overall, the majority of participants were satisfied with the current content of the portal. The following quote illustrates the participants' view:

"I think the fact that you can customise it from year to year shows that you have different needs, different supporting needs for each year. I could tell that for someone who has been through the system and knows the kind of stress of being a research student and things that they need at different stage, I think that is very helpful".

HASS1_I

Despite their favourable comments towards the relevance of the portal's resources, participants also identified additional information that should be included within the portal. Several types of additional information were identified such as postgraduate contact information, English language support and others. This additional information has been discussed in detail in the previous sections, and thus will not be repeated here.

Quality of Content

Based on the analysis of the transcripts, it was found that the quality of the portal's content was widely debated. In particular, participants were concerned with the quality of the hyperlinks from external sources. The analysis showed that the majority of the participants would be more confident if the hyperlinks were from official websites. For example, instead of providing a hyperlink to an unknown website to illustrate information about the Newcastle upon Tyne City, a hyperlink to the Newcastle City Council website was suggested.

However, if external hyperlinks that illustrate general information such as 'stress management' or 'presentation skills' were of an acceptable quality, it would be reasonable if it was from other websites. The following quotes illustrate this point:

"I guess you probably would read it and then check whether it is the same thing that you have at Newcastle. (After reading the material) But it sounds right. That is really good. I don't think you would find that wrong. No, that is good".

MED3_I

"Well, I think it depends on what it is, I mean if it is general information about seminar and stuff, then I think you can tell whether it is good or not".

HASS1_I

The analysis also showed that participants perceived some of the external hyperlinks such as 'how to write your research proposal' within the 'Applicants' tab to be useful. However, participants believed that it would be more useful if there were some guidelines about writing a proposal from the case University, since some schools required a research proposal as part of an application for a research degree. Furthermore, the participants commented that they would trust the materials developed by their own institution more than other external information as it would be relevant to them. The following quote illustrate this point:

"... It would be good if the university could develop its own content. Then you will pay more attention to it. You obviously know that it was definitely, what would be expected from the University".

HASS1_I

Furthermore, there were comments made concerning the suitability of links being included within the portal. Even though the researcher explained at the beginning of the focus group that the links were included only to represent research students' information needs, participants expressed their concern toward the process of choosing the links. This finding showed that care should be taken when identifying relevant links for the actual portal. The issues of only including quality links should be considered by the developer of e-learning.

Perceived Benefits

In terms of the perceived benefits of the portal, participants identified several advantages of the portal during the focus group discussion, as well as in the interviews. The major benefits were the personalisation and customisation of the portal, the availability of the portal's resources, the time saving factor and a one-stop place for everything. Furthermore, some participants considered that they learned a great deal about both the research process and information resources from participating in the study.

Personalisation and Customisation

The majority of participants identified personalisation and customisation as the main benefits of the portal. They valued the fact that they could personalise the portal by developing and

maintaining their list of favourite websites through the 'Bookmark' facility and adding their favourites RSS feeds through the user-defined RSS feature.

In terms of the 'Bookmark' feature, the majority of participants considered that having a bookmark within the portal was an added advantage where they could easily save website links relevant to their research, as in the following quote:

"I think this feature is quite useful because sometimes at certain points you need to save some favourite links related to your research study".

DBA1_Group1

However, of the 35 participants, two were convinced that the 'Bookmark' did not add value to their portal experience. The reason given was that they already maintained bookmarks on their personal computer, and thus did not need another one:

"My first reaction would be that I already have a system for my favourite websites. I will not log in to this portal just to find my favourite website, because I already have my own".

DBA2_Group1

In terms of the user-defined RSS function, the majority of participants valued this feature. This was shown in their feedback, when terms such as 'good', 'helpful', and 'excellent' were used when commenting on their experience of setting their own bookmarks and RSS feeds. Further analysis showed that the use of user-defined RSS function varied among participants. For example, first year participants reported that they used the RSS functions to receive an updated table of content from selected journals in their area for the purposes of their literature review. One participant remarked:

"During my literature review, I need to access numerous scientific papers from several journals. So by using the RSS function, I can just read the latest issue from the portal without going to the journal homepage".

MED3_I

In addition to receiving latest journals' tables of content, more advanced participants reported that they used the RSS function to receive updated news feeds from their favourite newspapers:

"... I always like to refer to different newspaper, different points of view".

HASS1_I

Customisation

As discussed in Appendix P the customisation of the portal was achieved through the 'Your preference' portlet, where users chose school, faculty, year of study, the number of RSS feeds and bookmark boxes. Based on this information, the portal pages were customised with appropriate content. One of the customisation features was the RSS feed for news or events from faculties and schools. The analysis showed that views relating to this feature were varied. The full-time participants particularly appreciated this feature more than the part-time participants. As one full-time participant remarked:

"I think you definitely need it from the school. I mean the thing is actually good to have it there because then you can just look down it quickly and I think most of us probably missed most of what is going on at the school because we just don't bother to check".

HASS1_I

On the other hand, the majority of part-time participants perceived the faculty and school news or events as not useful. Since all part-time participants in this study live far away from the main campus, the distance was one of the reasons given for their views against the RSS feeds feature. They argued that a lot of travel expenses would be spent if they wanted to attend events held at the case University. However, they believed that if the events were specifically for them, then it would be worth travelling to the main campus. Furthermore, they felt that they were not part of the case university community. This might be because these students were registered in the collaborative DBA programme between the case university and a European institution.

The second customisation feature was achieved by ordering tabs to demonstrate the relevance of information based on the users' stage of study. As discussed in Appendix P originally this customisation feature had a limited capability. According to the analysis of the focus groups and interviews, the feedback on this feature was positive. The majority of participants supported the idea of presenting relevant information based on their year of study. However, the analysis showed that some participants were initially confused by the ordering the tabs because of customising the 'year of study'. This might have been because of the changes in the order of the tabs were not visible to the users. As discussed in Appendix P based on the analysis of the focus groups and interviews, appropriate requirements were developed and delivered by the development team. The final prototype was again demonstrated to selected users from the three faculties. The analysis of these transcripts showed that the participants

appreciated this new development. Furthermore, the observation showed that participants easily understand the purpose of the 'year of study' preference when the researcher demonstrated to them.

The third customisation was achieved by presenting appropriate information regarding the faculty's research training programme based on the 'faculty' input information. The analysis showed that the majority of participants valued this feature. The fact that they not only can view their own faculty RTP information but also other faculty RTP gave added advantage. As these training modules occasionally complement each other, participants believed that by having this feature they would be more informed about offering from other faculties. The following quote reflected on this point.

"This is great! I missed some training courses from HASS before because I didn't get their information on time. This is good. You can see what other faculties offer and just register your name".

MED3_I

Anywhere and Anytime

In addition to personalisation and customisation, the participants also identified the flexibility of accessing the portal's resources as the main benefit of the portal. This view was supported strongly by part time students, who argued that being part time students, the portal provided a place to refer about all aspects of their research:

"The resources are available online, right. Because now, I mean when I started I have a piece of paper related to my induction. I know it still somewhere in my apartment but I mean if I want the paper, I need to search my apartment, but with the portal, I can just go to the appropriate page and access it".

DBA2_Group1

"I think for a person who missed some of the things at the beginning, this portal is important to them. It covers everything you want to know about, even if you missed some parts, the information is still there. You can always go back to it at any time".

DBA3_Group1

Everything in One Place

Another benefit identified by the participants was the fact that the portal provided information resources in one place. They argued that one place for everything was one of the factors that made them make repeat visits to the portal. As one participant noted:

"What I found particularly helpful, I think was first of all one place where I can get all the information that I like to look up on a daily basis such as the RSS feeds and bookmarks. Also by having this, it is easy for keeping you up-to-date with certain research organisations that you like to keep up with. Because sometimes I have so many and it is easy to lose track.

The second point is the portal as being a point where you can get all the information at your fingertips, instead of having endless bits of paper that you are trying to file which are about different points that you will need. I mean I found them already, and I did not even start a PhD properly. I can't imagine the amount of paper that you will get telling you about this and at the end to have all this at one place. I can see that it is being extremely important because someone like me, this is an amazing resource".

HASS1_I

Since everything can be found in one place, it saves users' time. The next point illustrates the time saving benefit.

Time Saving

The 'one place for everything' echoed another benefit agreed by the participants, which was time saving:

"I think this portal is user friendly. Because it put everything that is required by a student in one place so it will save the time from browsing to unrelated pages".

MED2_I

Usability Issues

Usability is one of the important features of any new system. To be able to keep the users' interest, the system developed should be useful and easy to use. The analysis of the transcripts reveals that several usability issues including learning to operate the portal, navigation and naming of links were mostly discussed by the participants from the three faculties.

Learning to use the Portal

Based on the observation and analysis of the transcripts, proper guidance and training should be provided before users can properly use the portal. The analysis showed that participants with limited computing knowledge needed more time to personalise the portal. This is because to set up RSS feeds, users need to know the uniform resource locator (URL) of the RSS feeds. Some participants did not even know what RSS means, and needed explanation. However, participants who were accustomed to using the Internet found it easy to personalise

the portal once they were given training. Since the purpose of using the RSS feeds was to demonstrate the personalisation features, other technology which is more users friendly could be used instead. If RSS is used, a possible alternative might be to provide a more user friendly interface, where users just have to drag and drop their favourite RSS feeds.

Navigation

Based on the observation, as well as analysis of the transcripts, overall participants felt that navigating the portal was quite easy. However, since the portal provides links to external resources, once users follow any of the links, they will leave the portal permanently unless they use the 'back' button. Comments were also received regarding the need to go through many links before users reached what they were looking for. For example, one participant from the HASS Faculty argued that it took her several steps before she could find the information that she needed. This problem could be avoided if the portal were to provide a search function. Since the purpose of the prototype portal was to investigate the concept of e-learning in the research environment, developing a search function lay beyond the scope of this project. However, a developer of e-learning systems should consider this point when developing an e-learning application for research students.

Text Used to name Links

The analysis shows that the text used to name links was easily understood by most participants. The observation showed that no participants had any difficulty in browsing the portal. With regard to the description given beside each link, participants expressed the fact that the description was good, since it hinted to users where the resources linked. The description made it clear what the links were all about. The following quote illustrates this point:

"I think it is good that you explain that (referring to one of the link within the portal) because I would not know what 'Research Beehive' is. Even though I'm a home student, I would not know it, if you hadn't put the explanation beside it. It is alright we have all these fancy terms and once you know it, you know it. But, just a small explanation next to it is really helpful. As a perspective student, I would find that an explanation is helpful".

HASS1_I

Other Findings

The following quotes reflected the participants' views:

"In general, I really like it. It is very complete and useful because you do not have to ask around, because sometimes you have to ask people for advice, 'would you let me know where can I get this kind of thing' or whatever. Now with the portal it is just a click away to find what you need".

DBA2_Group2

"I think this portal is very good because just like I said before, the things that I need are in there. I don't have to go elsewhere to find them; everything has been sorted out for me in here. So it is really useful".

MED2_I

Portal Supported the Life Cycle Approach

The objective of the portal was to support research students at each stage in their study by providing relevant information based on their disciplines and year of study. In terms of this objective, the analysis revealed that this objective was fulfilled. The following quote reflected the participants' views.

"This portal shows us the plan from the first day we arrive … No, no, before we arrive, it supported us at the stage where we were applying and towards the end of our study so everything has already been guided for us. That's why I need to refer to it because if I didn't refer, I might miss something out".

MED2_I

Portal as the Point of Reference

The analysis showed that some participants perceived the portal to be a place which they could refer to at any time. The portal might not only support students who missed their induction sessions, but importantly, support them throughout the research student's life cycle. The following quote shows this point from the participant's views:

"It is just like a place we can refer to after the induction programme, if we missed out or forget something we can always go back to the specific sections of this portal".

DBA1_Group2

Benefited First Year Students the Most

The analysis showed that participants perceived the portal as most beneficial to first year students. Participants who registered at unusual times believed that the portal helped them clarify the steps that they needed to follow in the first year. For example, the practice within the case University was that the supervisor and students were required to sign an agreement regarding the expectations of a research programme in the first year. The following quotes

illustrate this point:

"I have been registered for two months; however, I still don't know what I have to do next. Since I registered on the first of July, the Graduate school informed me that I have to register again in September and attend induction sessions after that. So if I have something like this then, where everything is on one page, I would know what to do next.

… I received an email from the Graduate school stating that submission of the 'Learning agreement' was overdue… I don't have any idea what is that … I asked my supervisor, ok wait, I think I need to submit this form (referring to the learning agreement form within the portal)".

MED2_I

Furthermore, third year participants argued that the portal would also benefit them if it had been developed when they were in their first year. The following quote illustrates this point:

"It is more helpful, I think for first year students because they face many problems, how to get access to certain information, if they found all this information in one web page, that will be great".

MED3_Group1

"If I have had something like this in my first year, it would have been very useful".

DBA1_Group2

Overall, the majority of participants supported the portal approach as a tool to support the research process, favouring the following major features of the portal such as personalisation and customisation, flexibility and time saving.

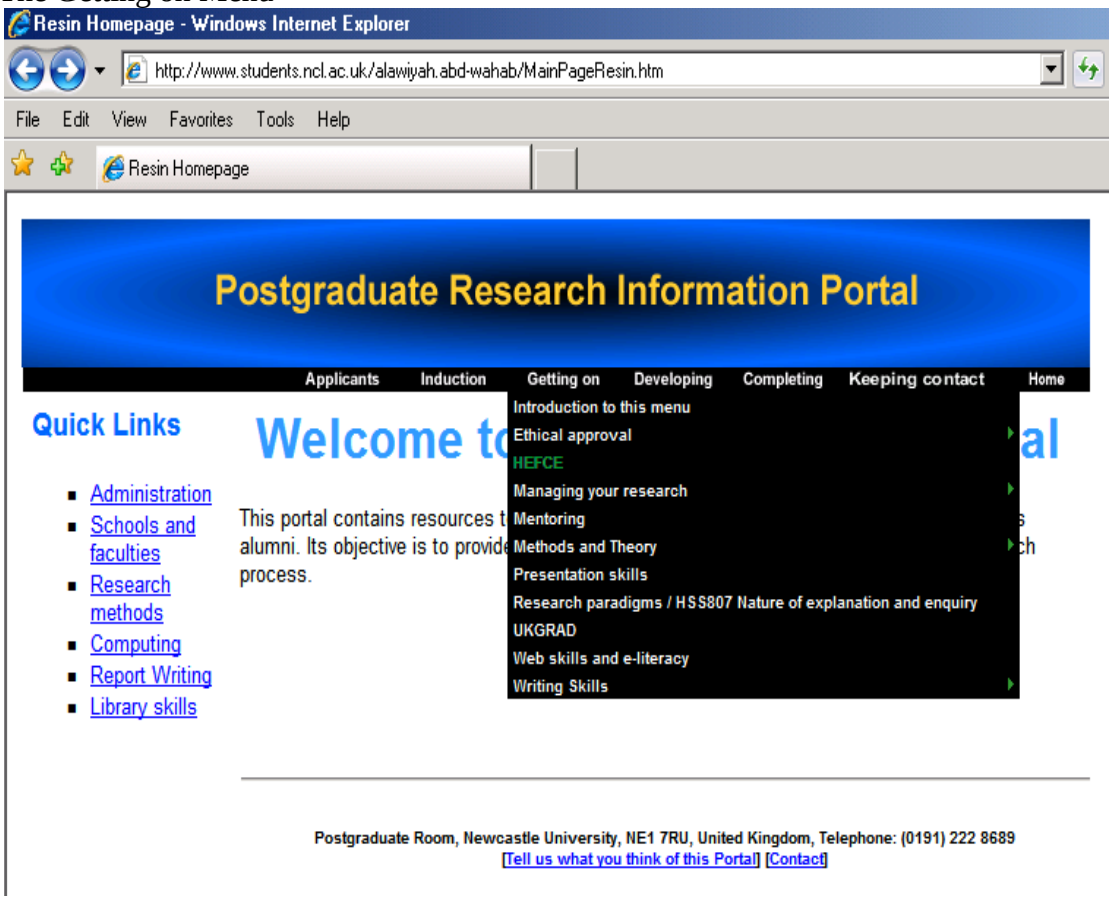
Appendix K Screenshots of Static Research Portal

1. The welcome page

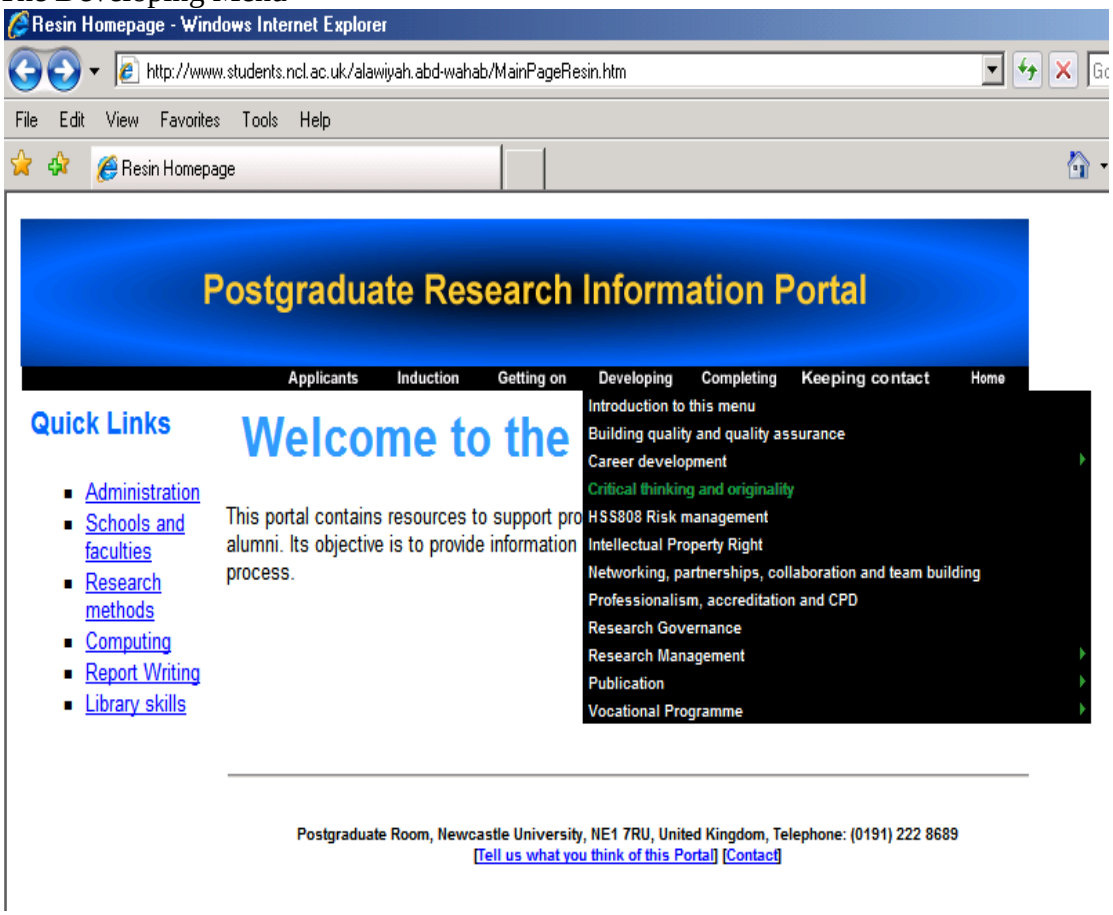
2. The Applicant Menu

3. The Induction Menu

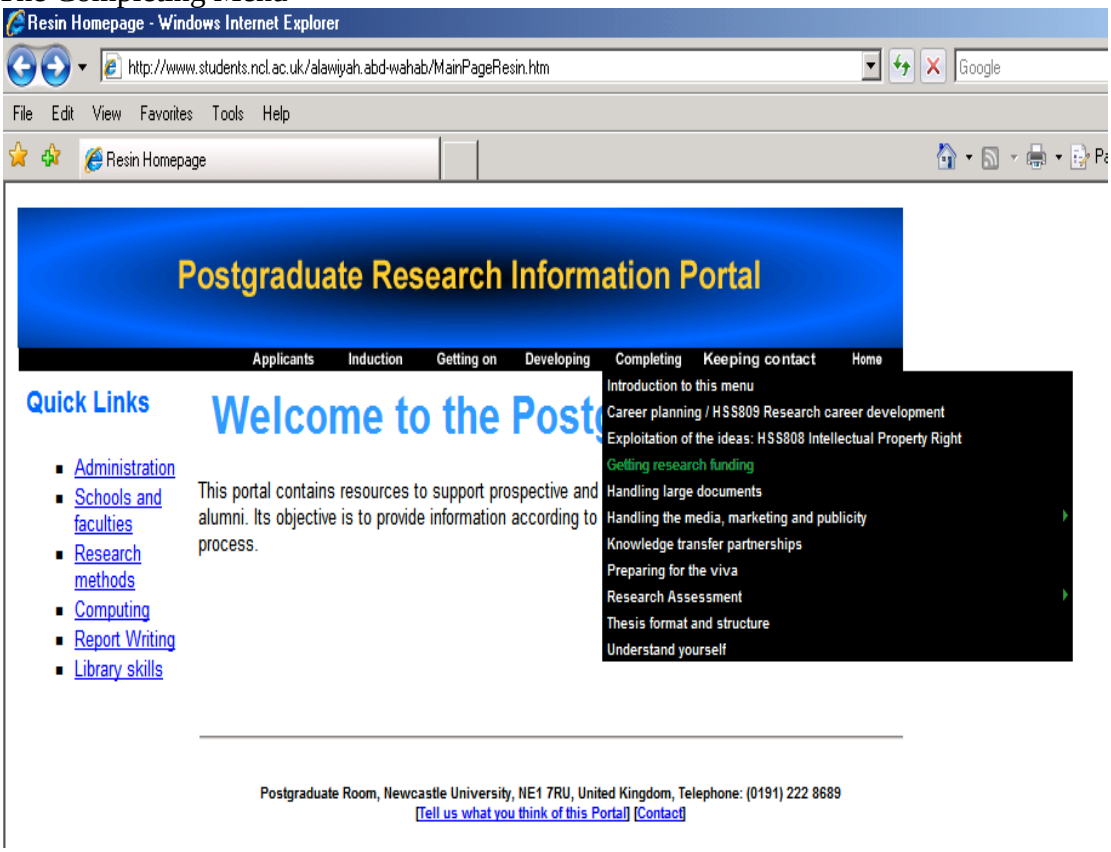
4. The Getting on Menu



5. The Developing Menu



6. The Completing Menu



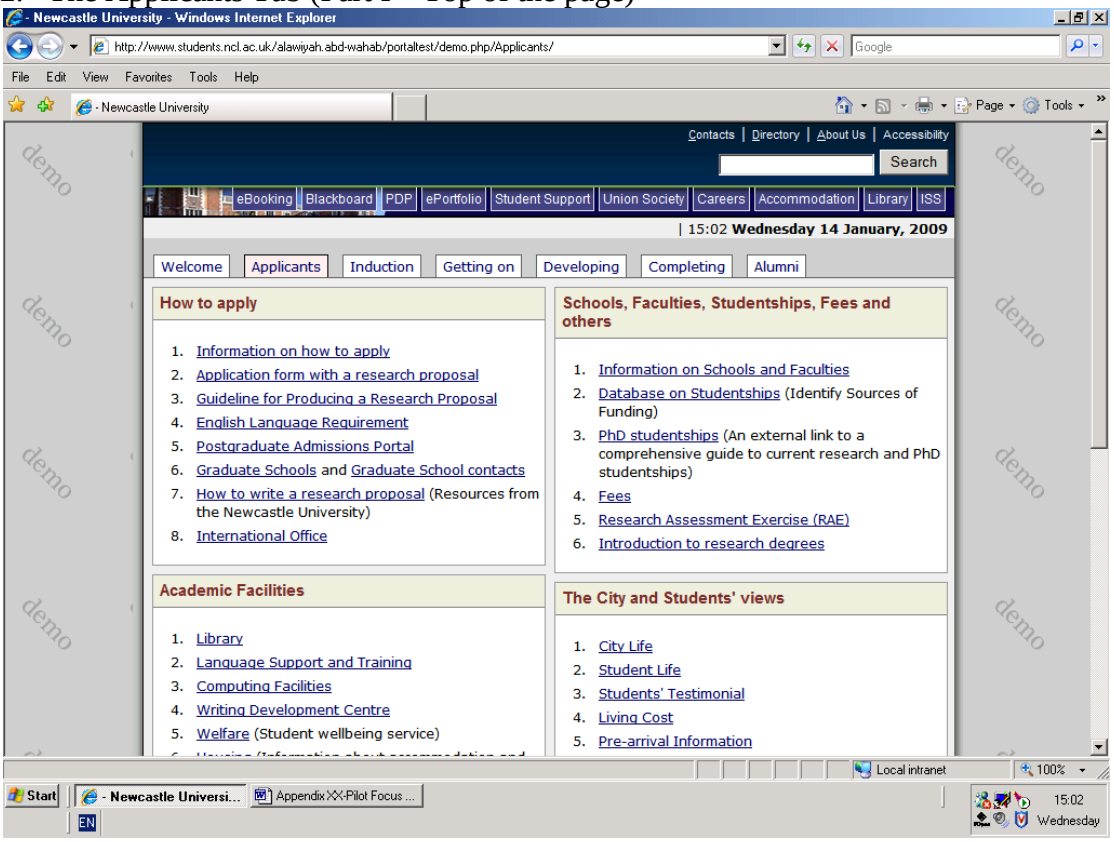
7. The Keeping Contact Menu

Appendix L Screenshots of Research Portal used for Cycle Two

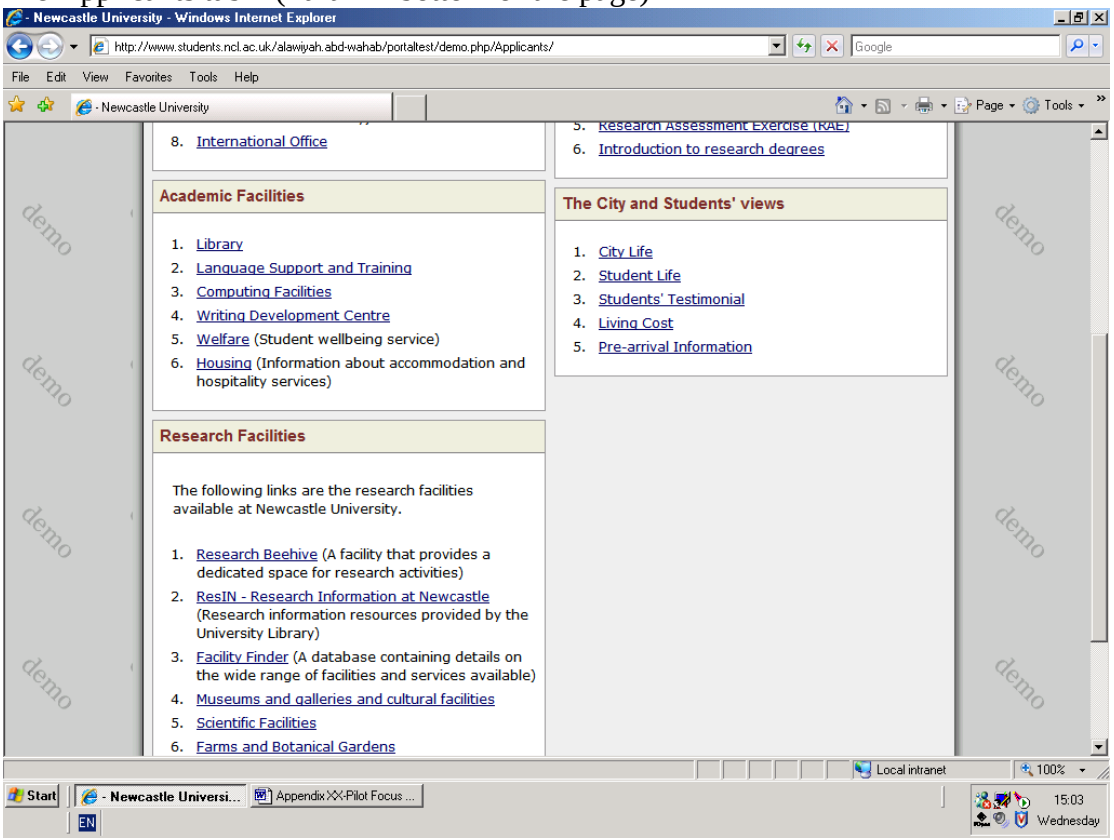
Note: some of the links in these screenshots have been updated based on the analysis of the finding from the pilot studies.

1. The Welcome Page

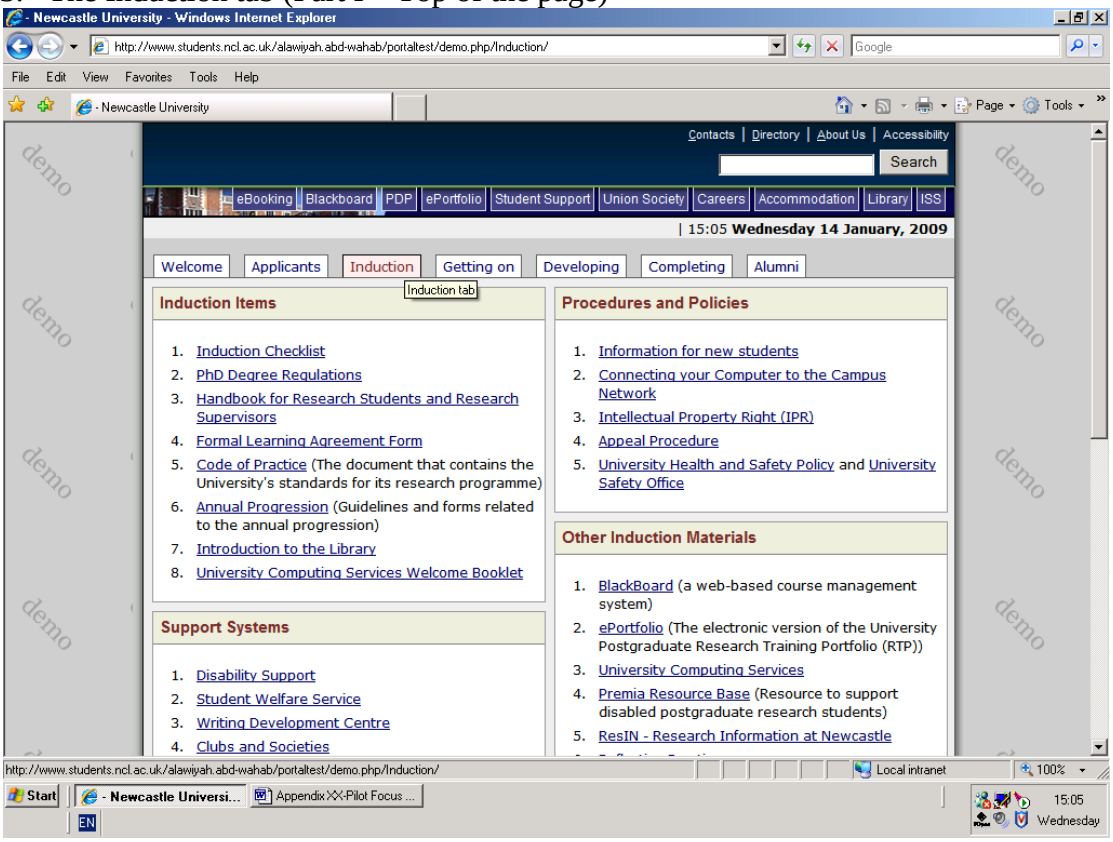
2. The Applicants Tab (Part I – Top of the page)



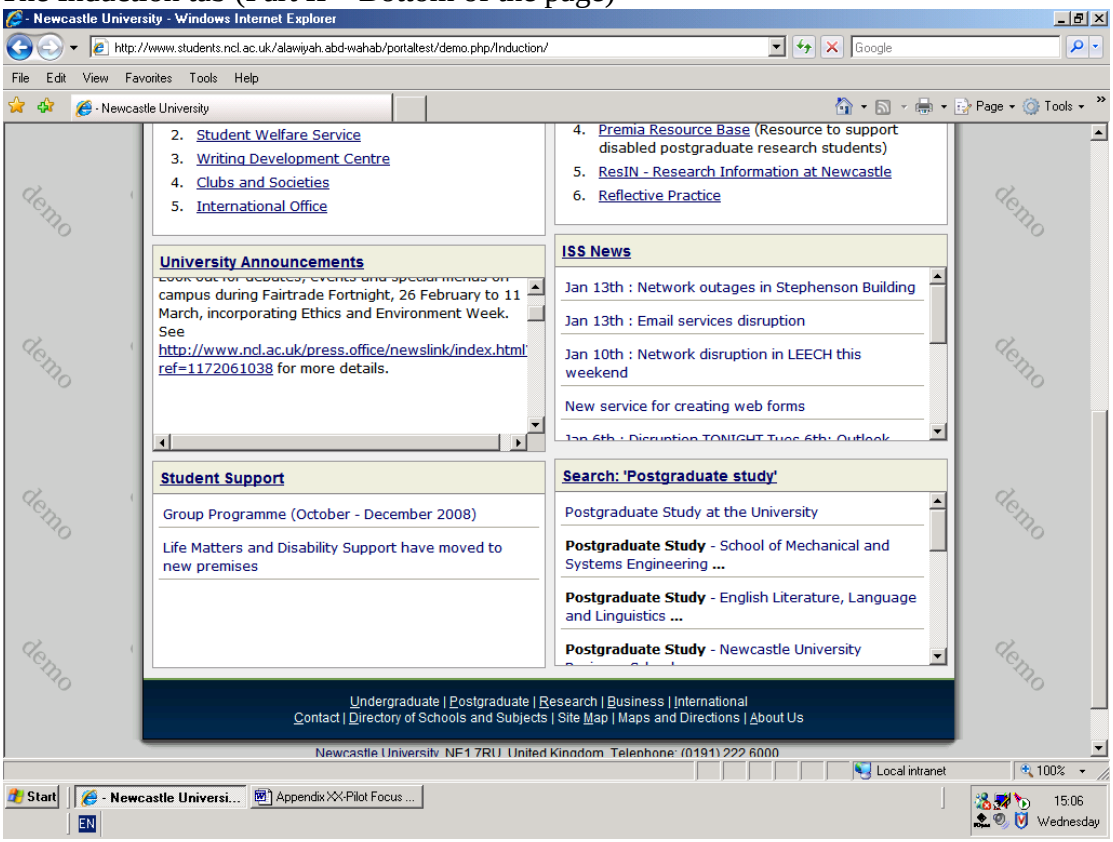
The Applicants tab – (Part II – bottom of the page)



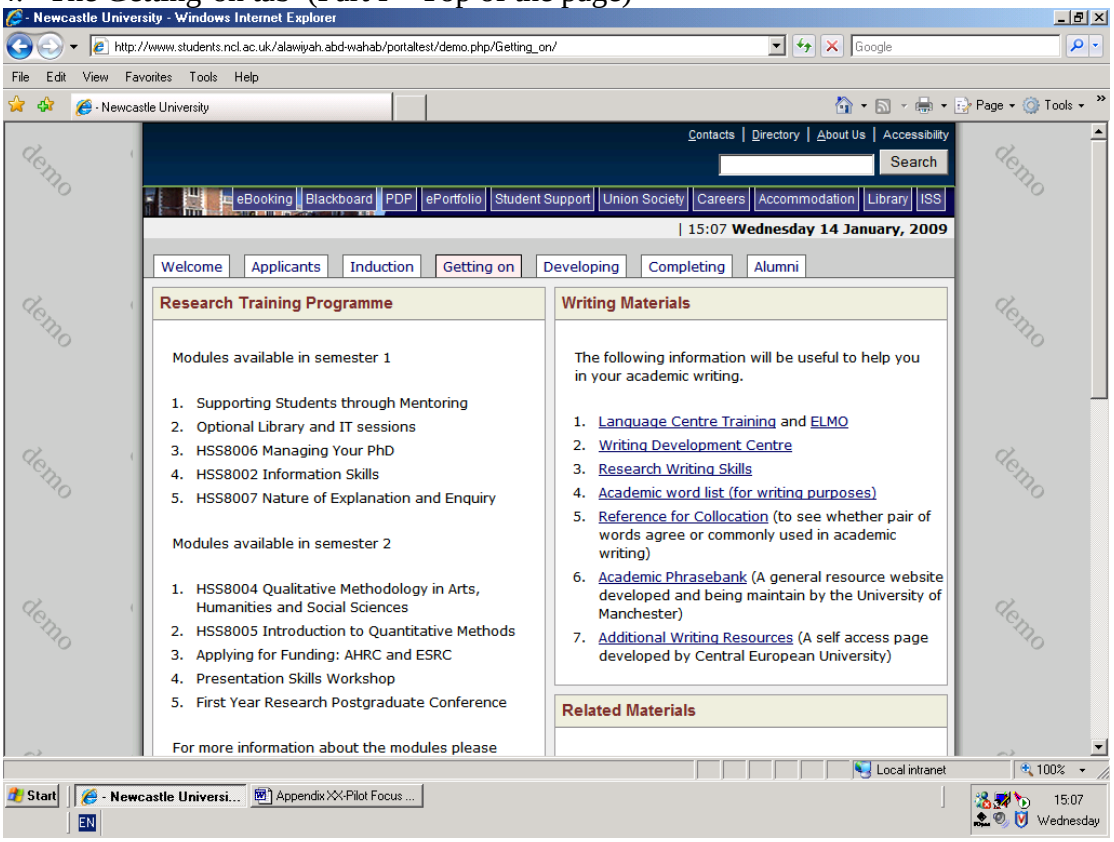
3. The Induction tab (Part I – Top of the page)



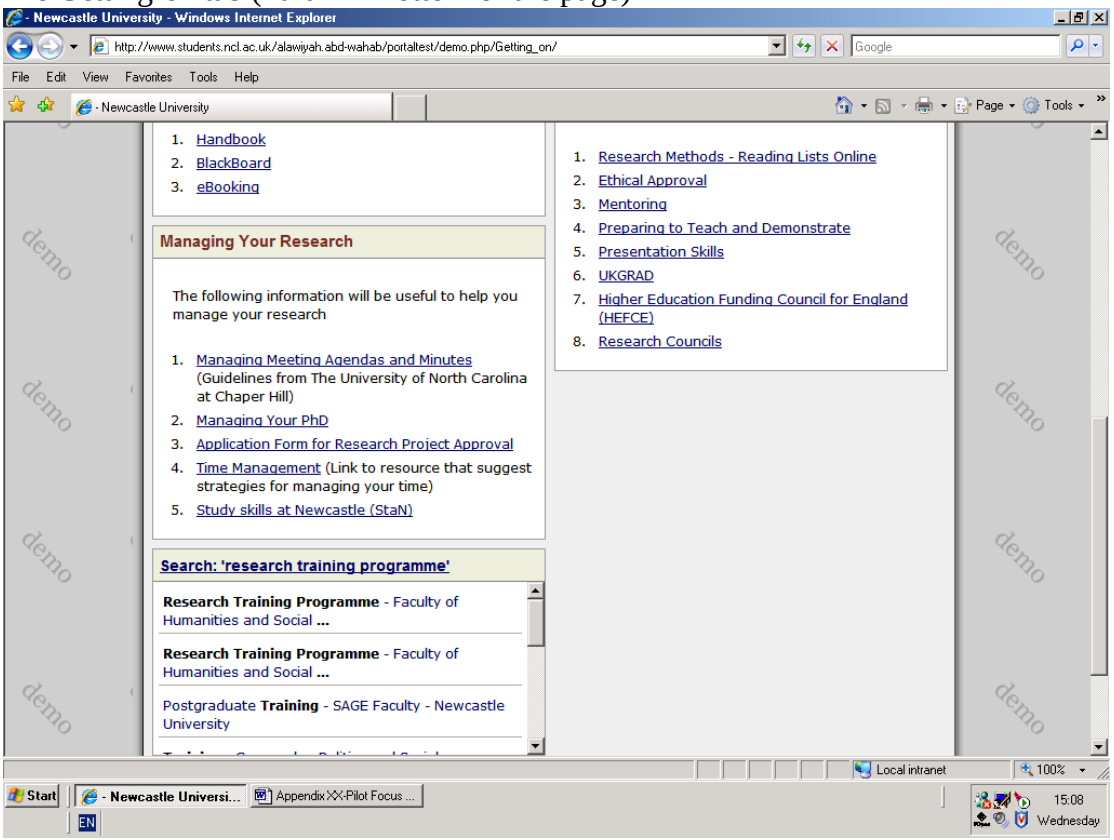
The Induction tab (Part II – Bottom of the page)



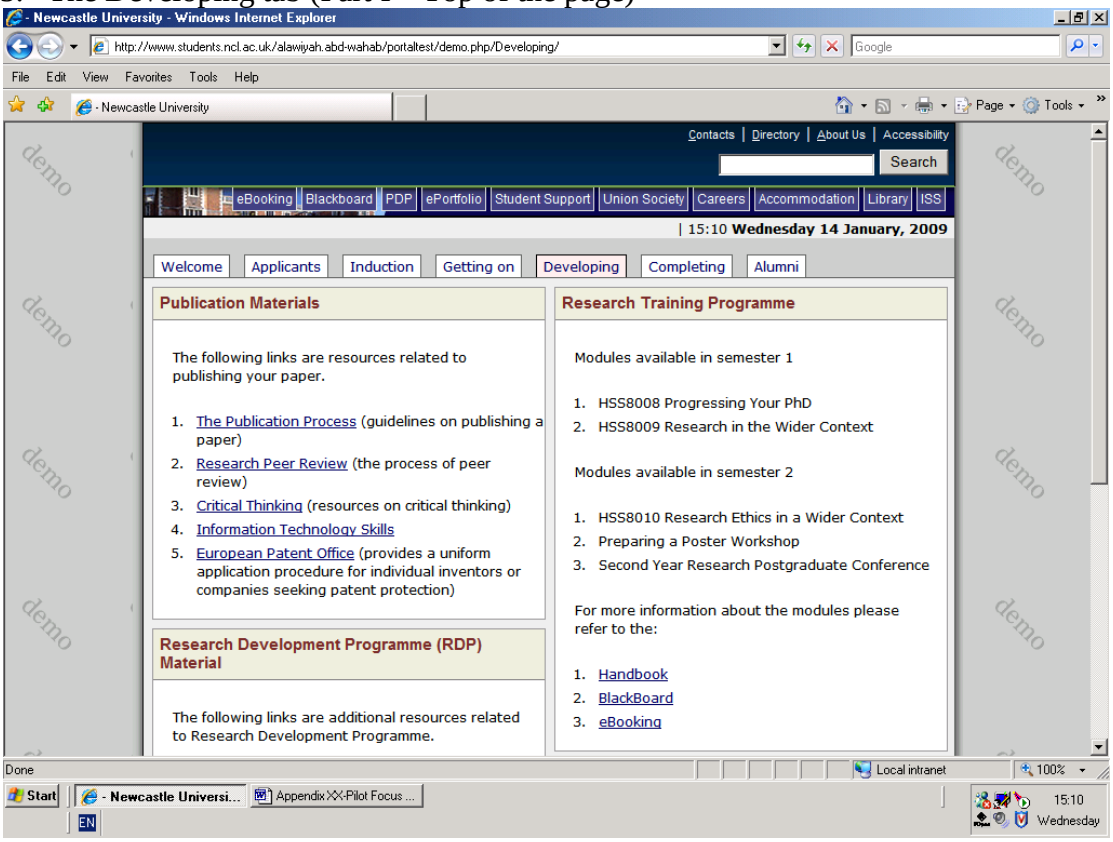
4. The Getting-on tab (Part I – Top of the page)



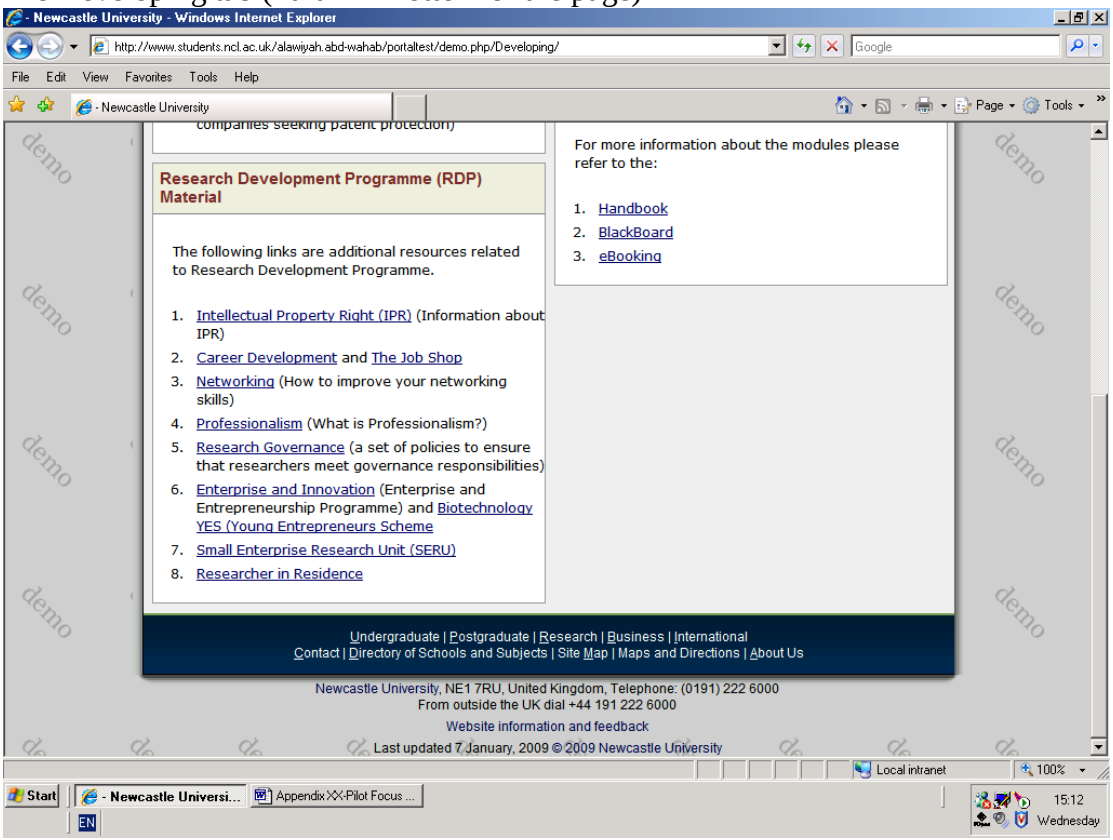
The Getting-on tab (Part II – Bottom of the page)



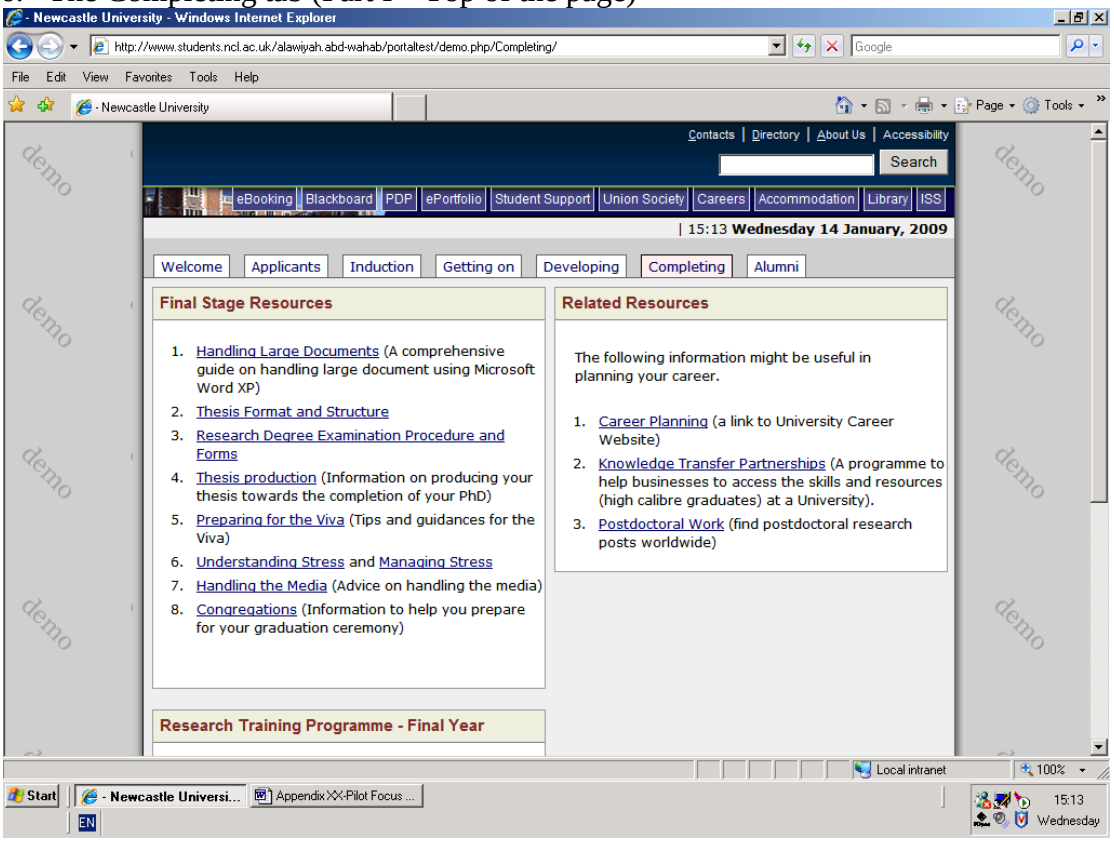
5. The Developing tab (Part I – Top of the page)



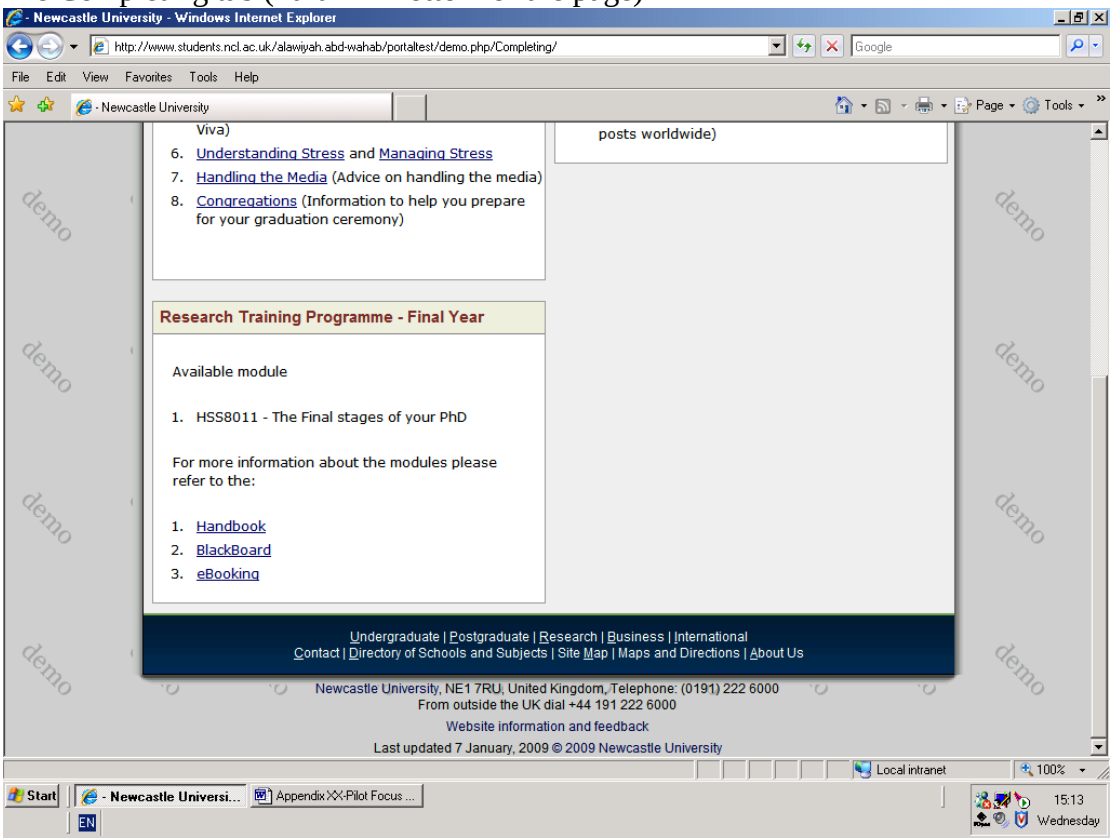
The Developing tab (Part II – Bottom of the page)



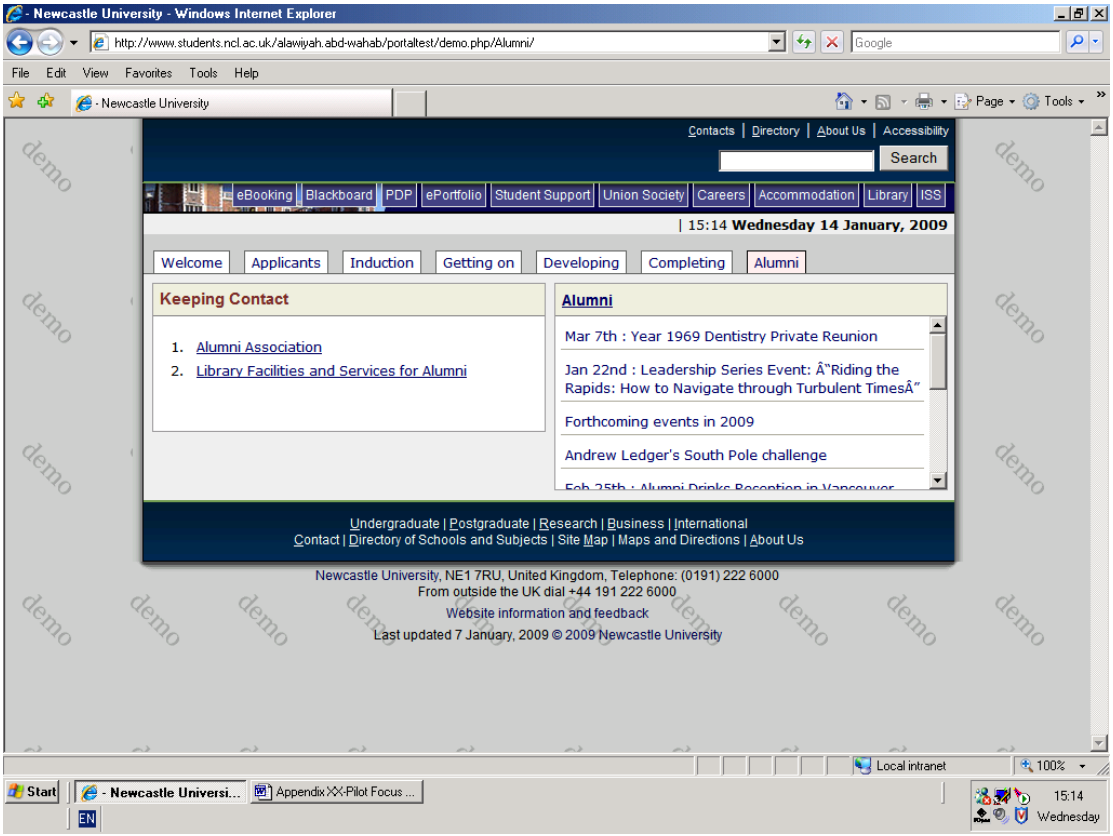
6. The Completing tab (Part I – Top of the page)



The Completing tab (Part II – Bottom of the page)



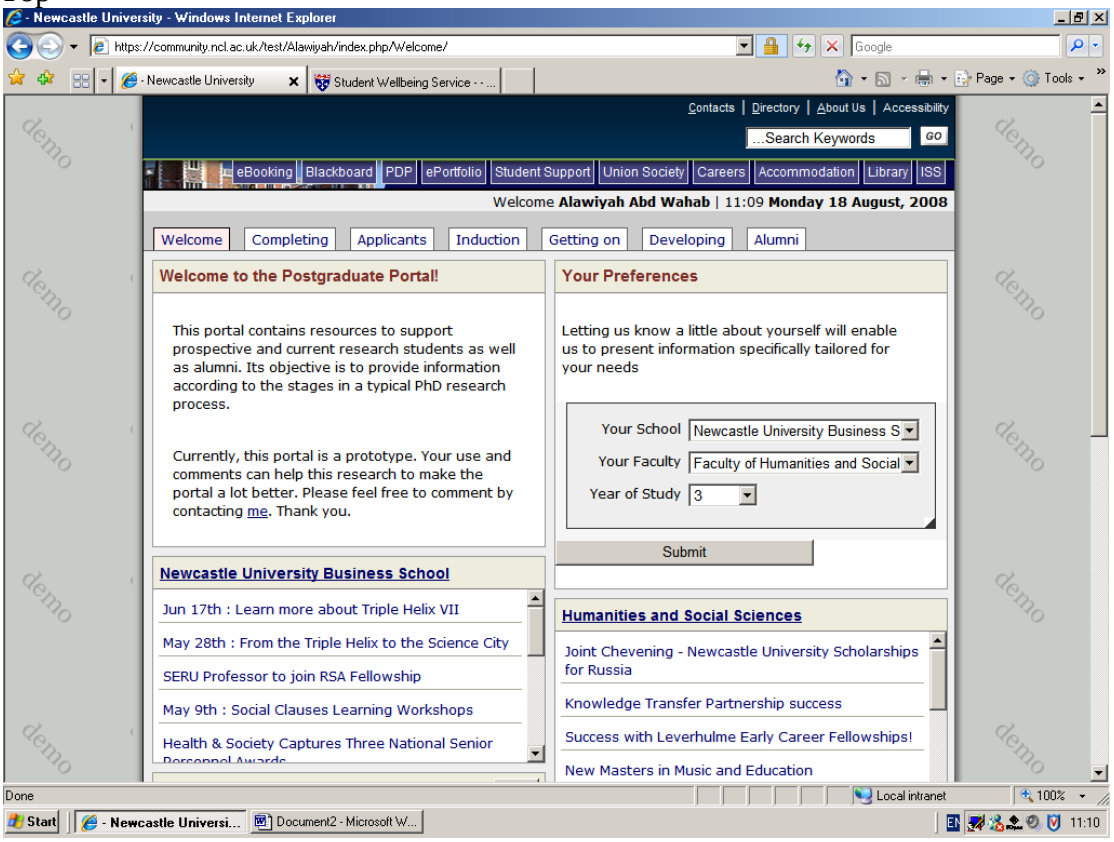
7. The Alumni tab



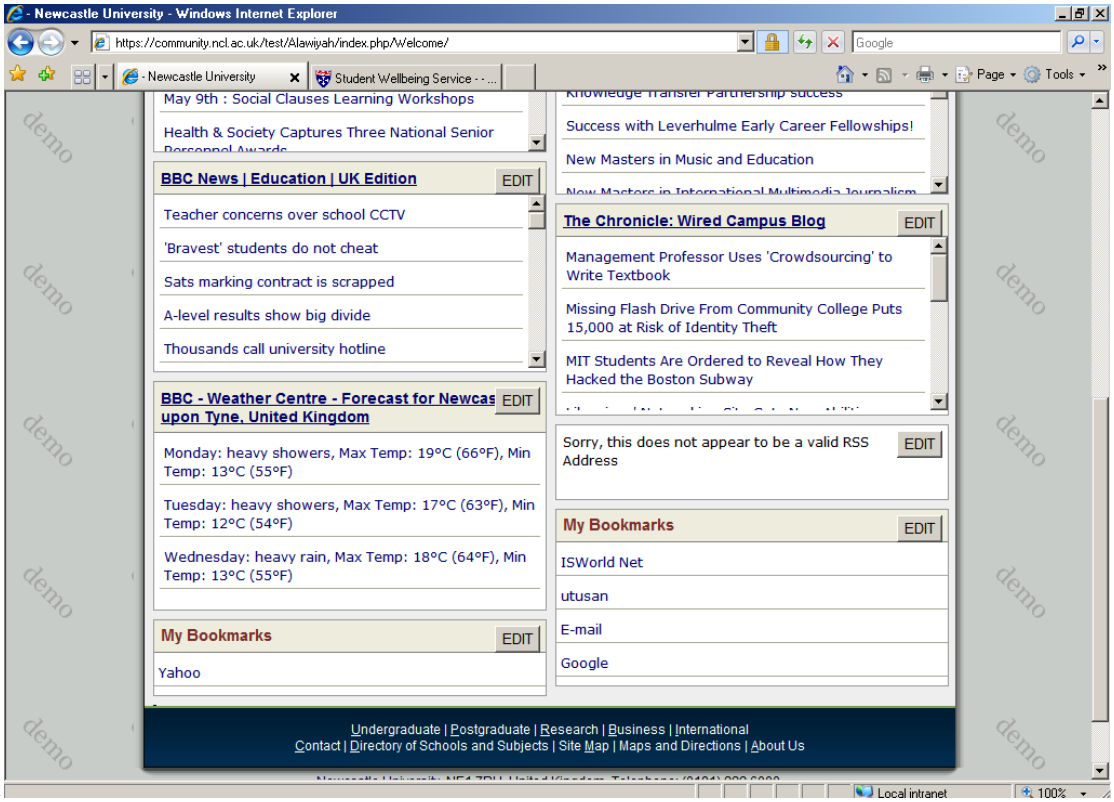
Appendix M Screenshots of Research Portal used for Cycle Three

Main Page – Welcome

Top

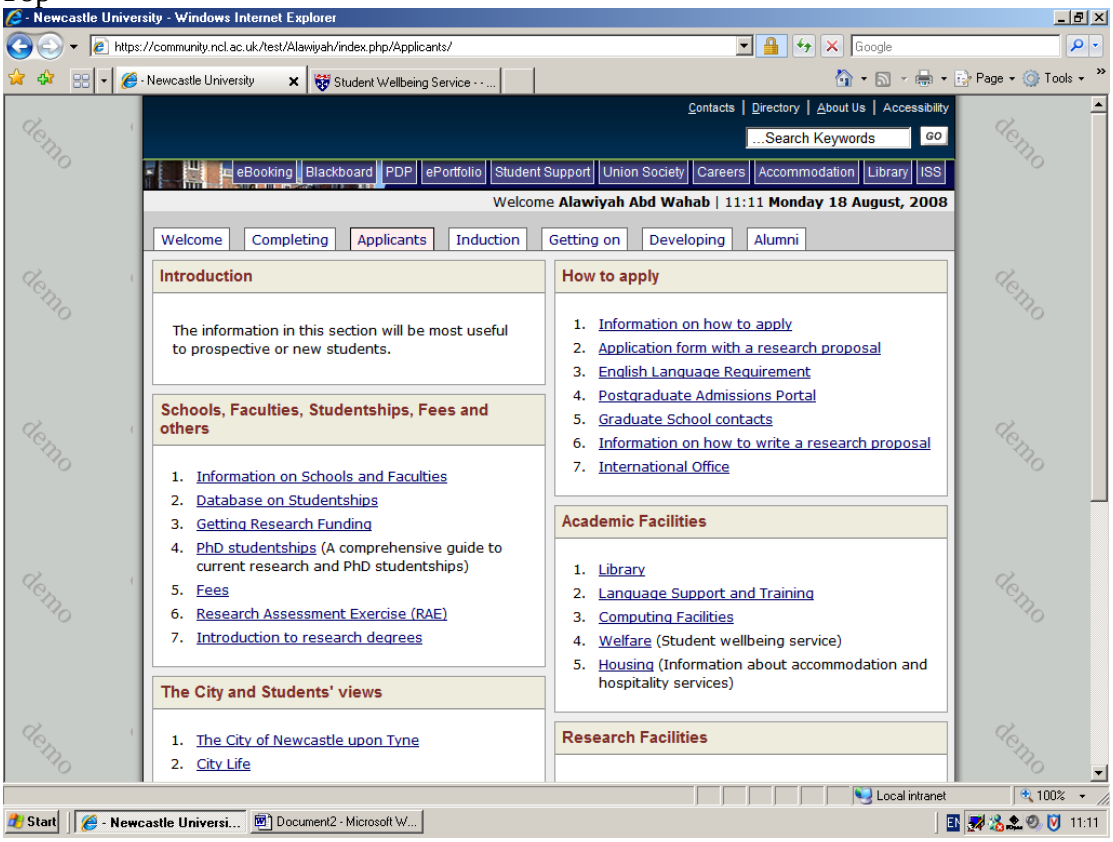


Bottom

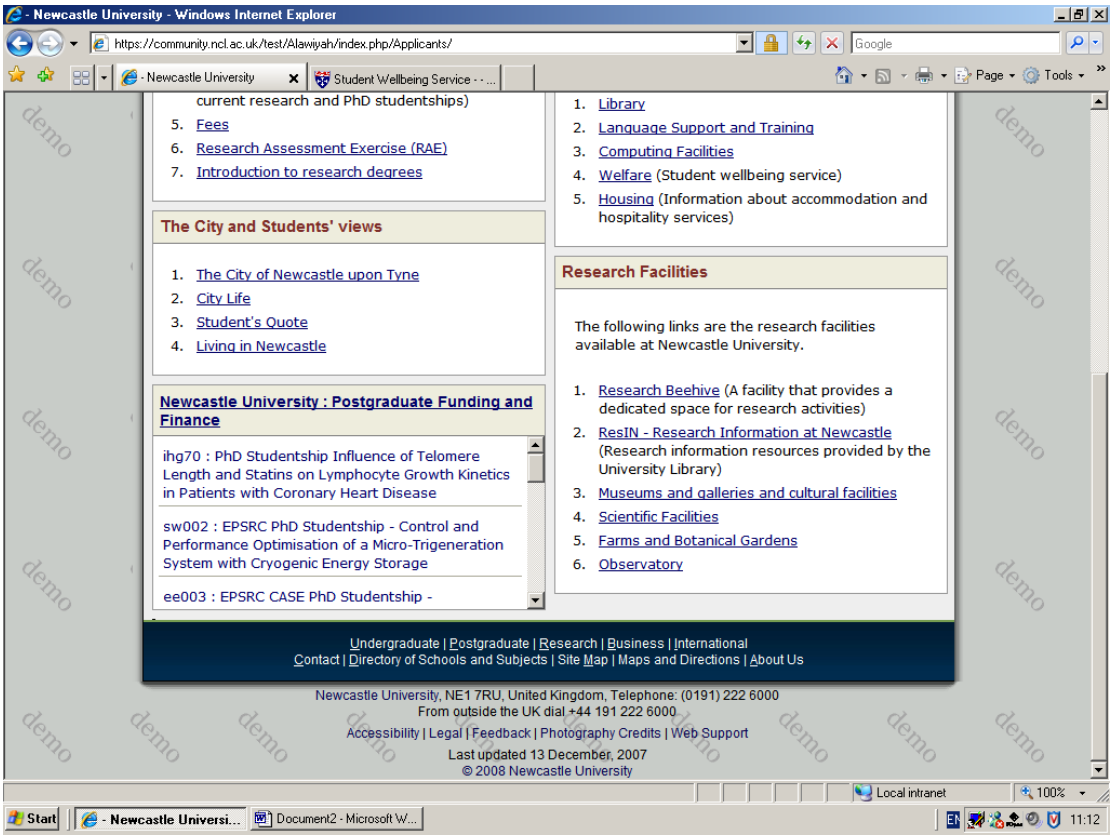


Applicant tab

Top


- Newcastle University - Windows Internet Explorer
https://community.ncl.ac.uk/test/Alawiyah/index.php/Applicants/
Contacts | Directory | About Us | Accessibility
...Search Keywords
GO
eBooking | Blackboard | PDP | ePortfolio | Student Support | Union Society | Careers | Accommodation | Library | ISS
Welcome Alawiyah Abd Wahab | 11:11 Monday 18 August, 2008
Welcome | Completing | Applicants | Induction | Getting on | Developing | Alumni
Introduction
The information in this section will be most useful to prospective or new students.
Schools, Faculties, Studentships, Fees and others
1. Information on Schools and Faculties
2. Database on Studentships
3. Getting Research Funding
4. PhD studentships (A comprehensive guide to current research and PhD studentships)
5. Fees
6. Research Assessment Exercise (RAE)
7. Introduction to research degrees
The City and Students' views
1. The City of Newcastle upon Tyne
2. City Life
How to apply
1. Information on how to apply
2. Application form with a research proposal
3. English Language Requirement
4. Postgraduate Admissions Portal
5. Graduate School contacts
6. Information on how to write a research proposal
7. International Office
Academic Facilities
1. Library
2. Language Support and Training
3. Computing Facilities
4. Welfare (Student wellbeing service)
5. Housing (Information about accommodation and hospitality services)
Research Facilities
Local intranet
100%
Start
- Newcastle Universi...
Document2 - Microsoft W...
11:11

Bottom


- Newcastle University - Windows Internet Explorer
https://community.ncl.ac.uk/test/Alawiyah/index.php/Applicants/
current research and PhD studentships)
5. Fees
6. Research Assessment Exercise (RAE)
7. Introduction to research degrees
The City and Students' views
1. The City of Newcastle upon Tyne
2. City Life
3. Student's Quote
4. Living in Newcastle
Newcastle University : Postgraduate Funding and Finance
ihg70 : PhD Studentship Influence of Telomere Length and Statins on Lymphocyte Growth Kinetics in Patients with Coronary Heart Disease
sw002 : EPSRC PhD Studentship - Control and Performance Optimisation of a Micro-Trigeneration System with Cryogenic Energy Storage
ee003 : EPSRC CASE PhD Studentship -
1. Library
2. Language Support and Training
3. Computing Facilities
4. Welfare (Student wellbeing service)
5. Housing (Information about accommodation and hospitality services)
Research Facilities
The following links are the research facilities available at Newcastle University.
1. Research Beehive (A facility that provides a dedicated space for research activities)
2. ResIN - Research Information at Newcastle (Research information resources provided by the University Library)
3. Museums and galleries and cultural facilities
4. Scientific Facilities
5. Farms and Botanical Gardens
6. Observatory
Undergraduate | Postgraduate | Research | Business | International
Contact | Directory of Schools and Subjects | Site Map | Maps and Directions | About Us
Newcastle University, NE1 7RU, United Kingdom, Telephone: (0191) 222 6000
From outside the UK dial +44 191 222 6000
Accessibility | Legal | Feedback | Photography Credits | Web Support
Last updated 13 December, 2007
© 2008 Newcastle University
Local intranet
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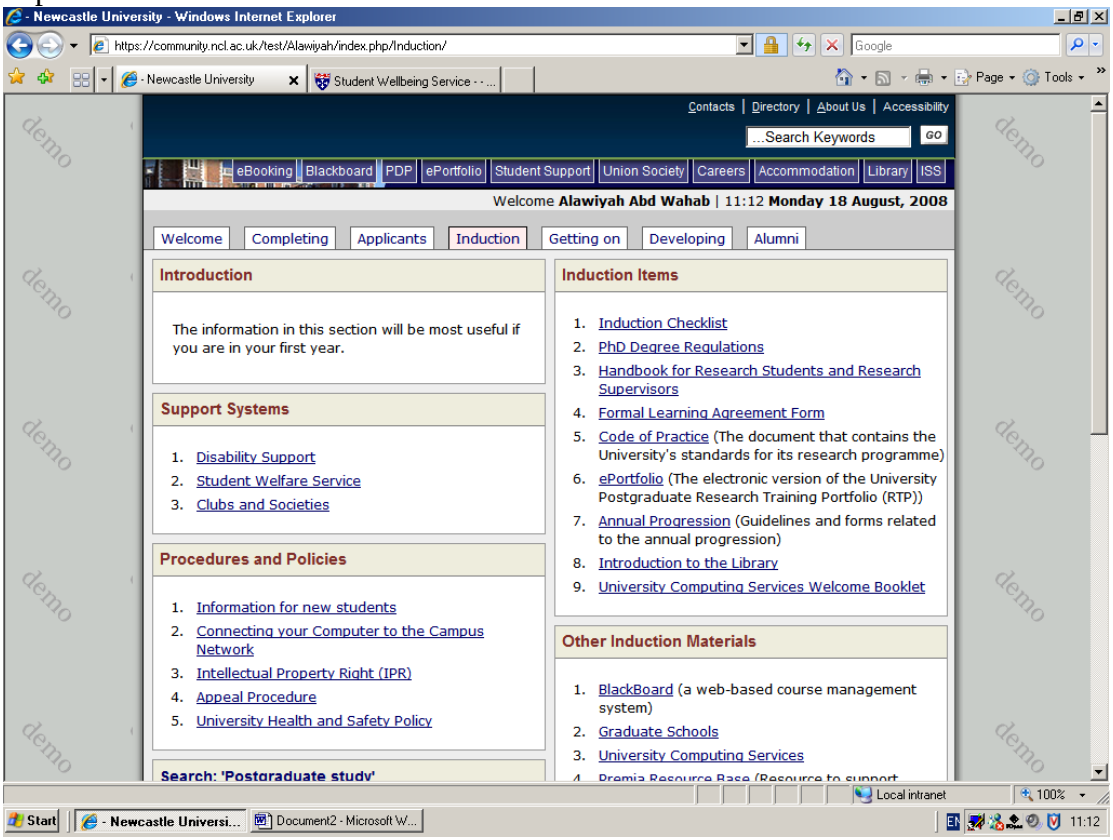
Start
- Newcastle Universi...
Document2 - Microsoft W...
11:12

Induction

Top



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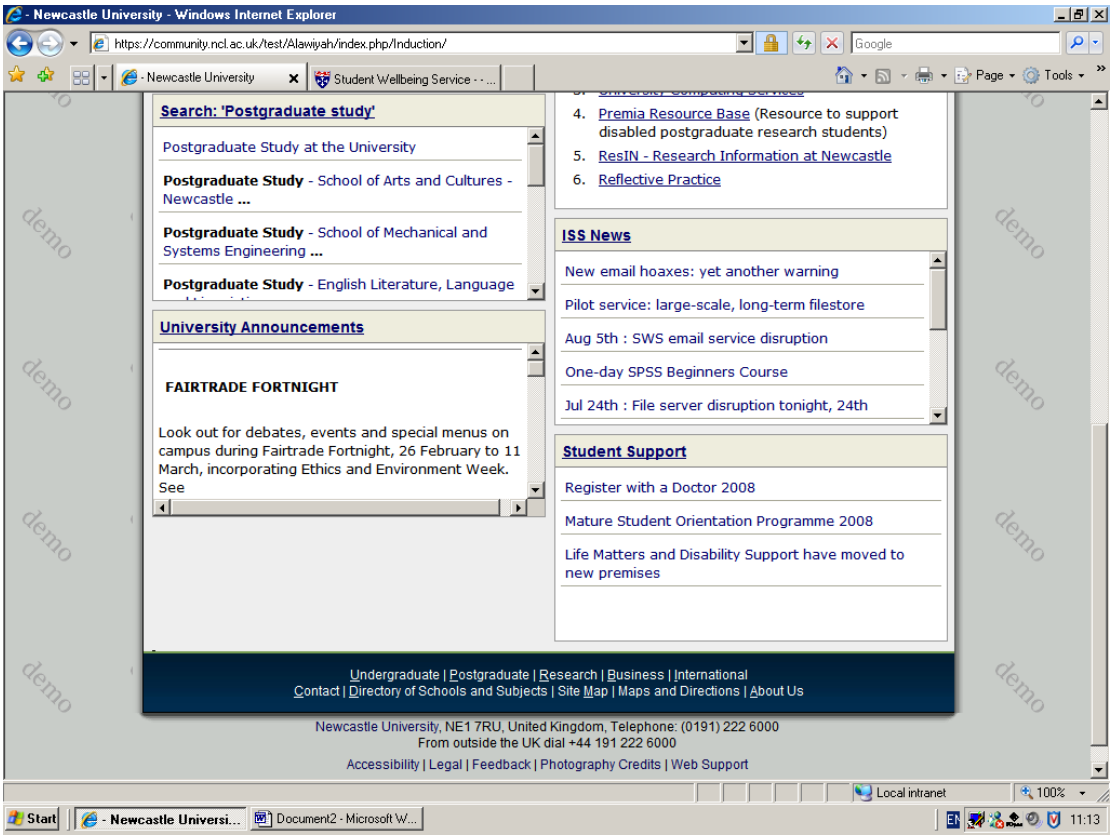
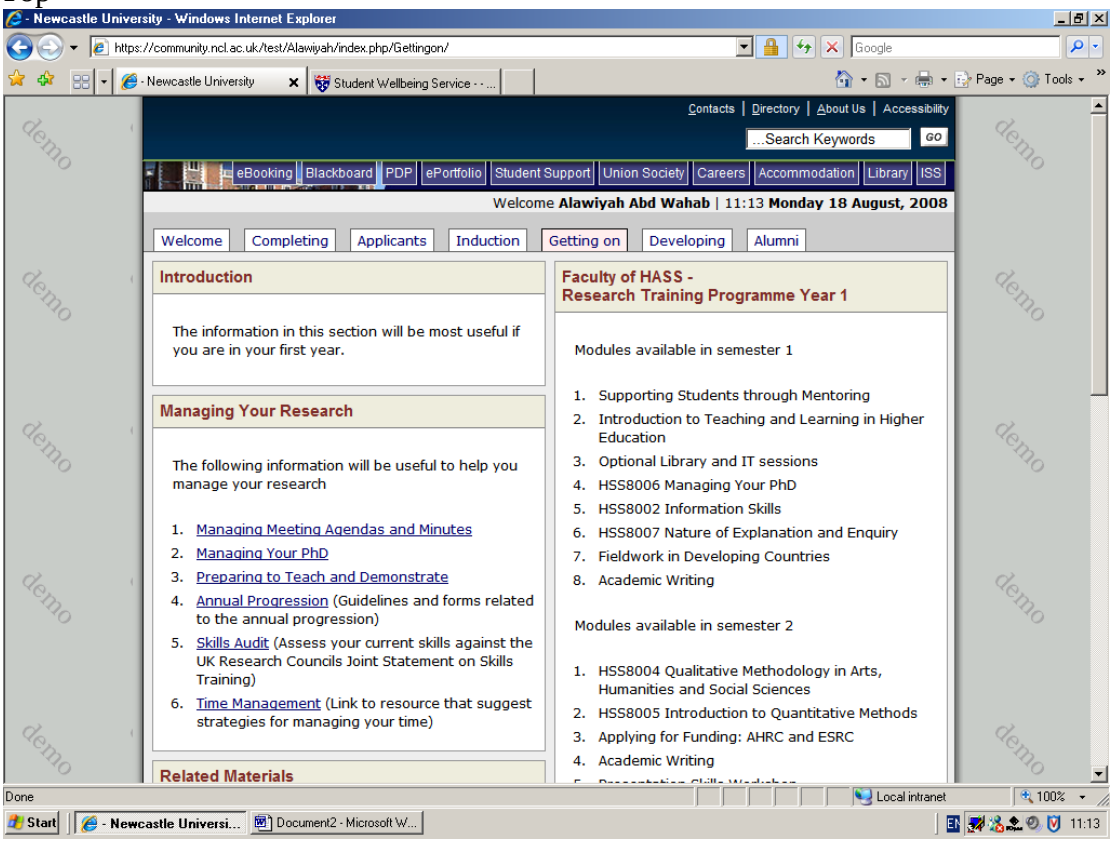


Getting on
Top



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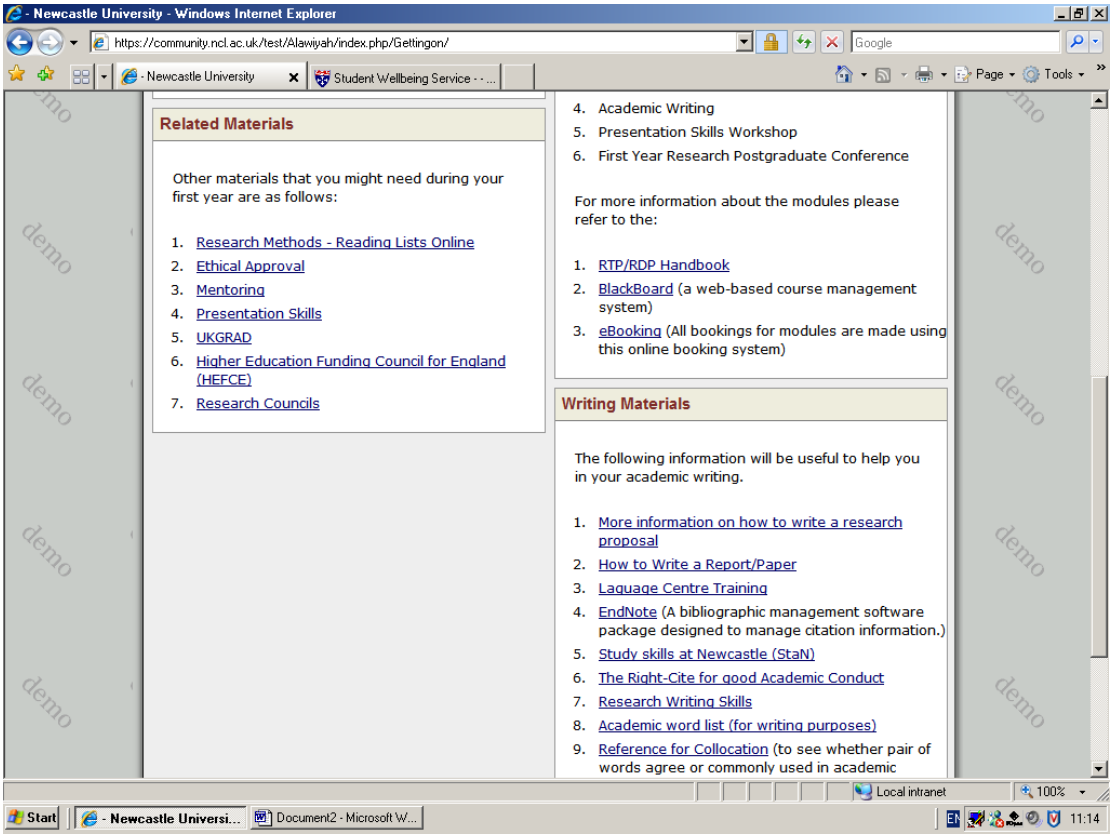
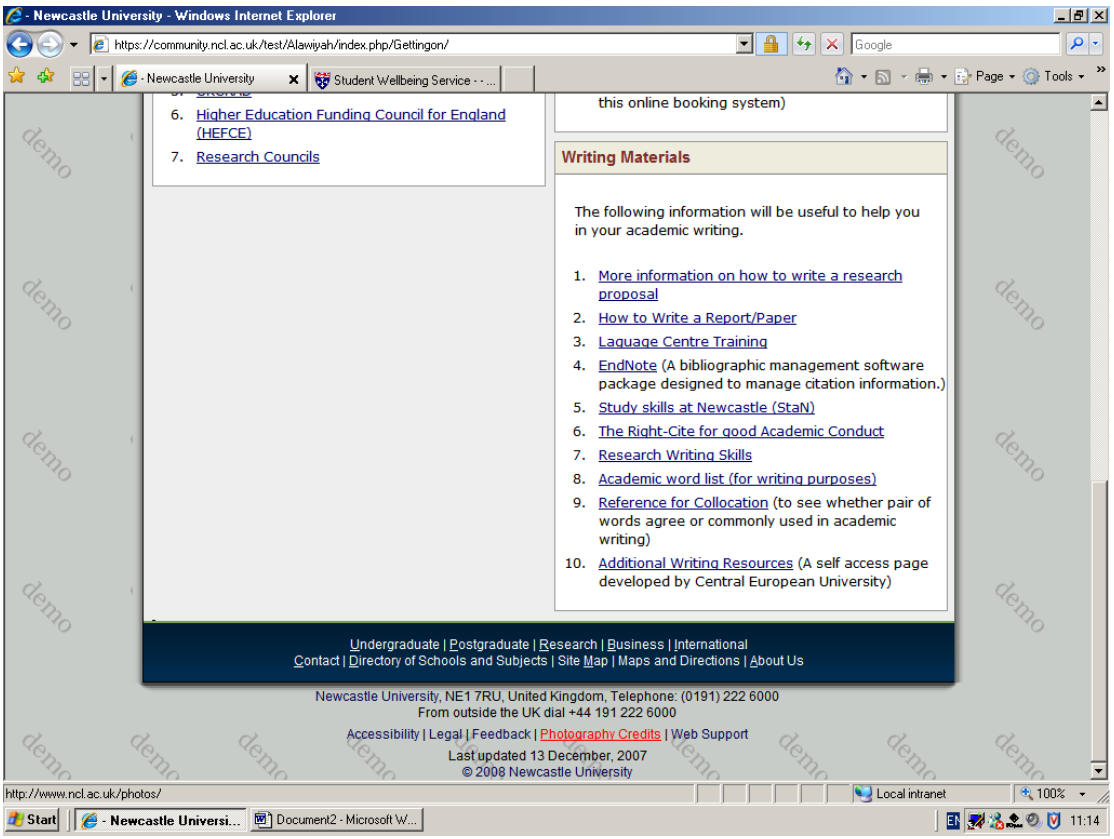
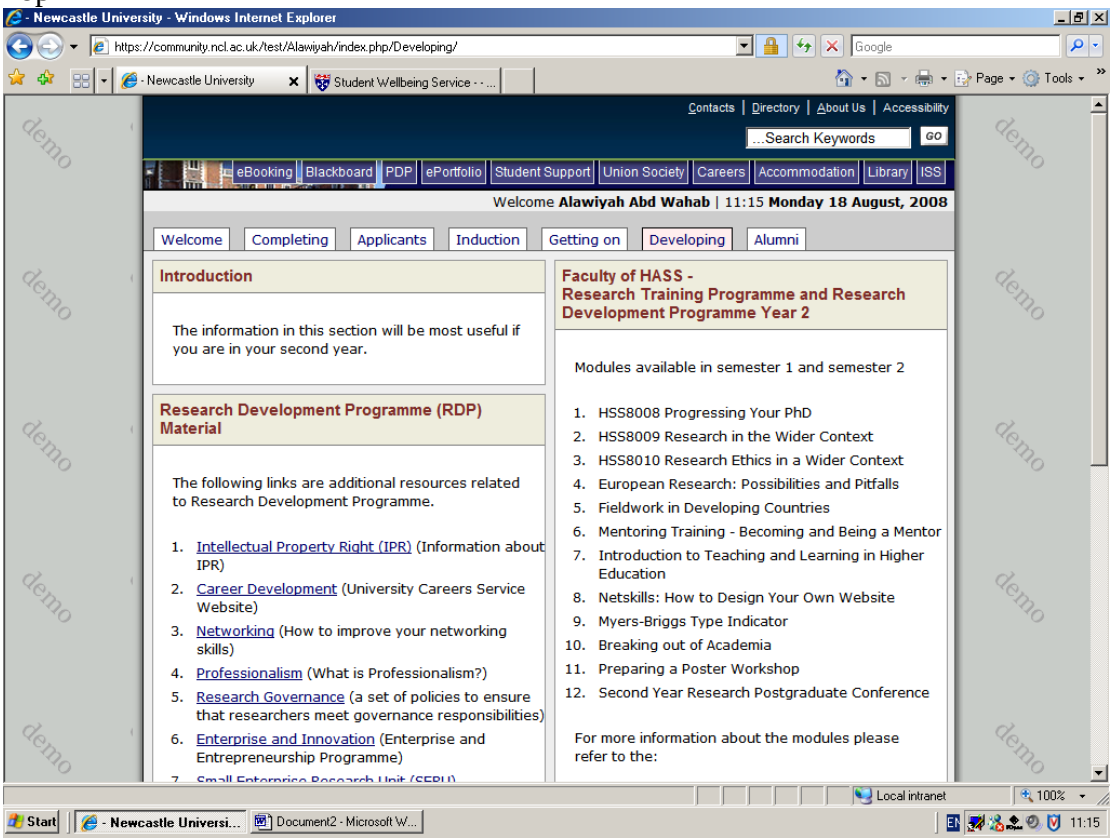




Developing
Top



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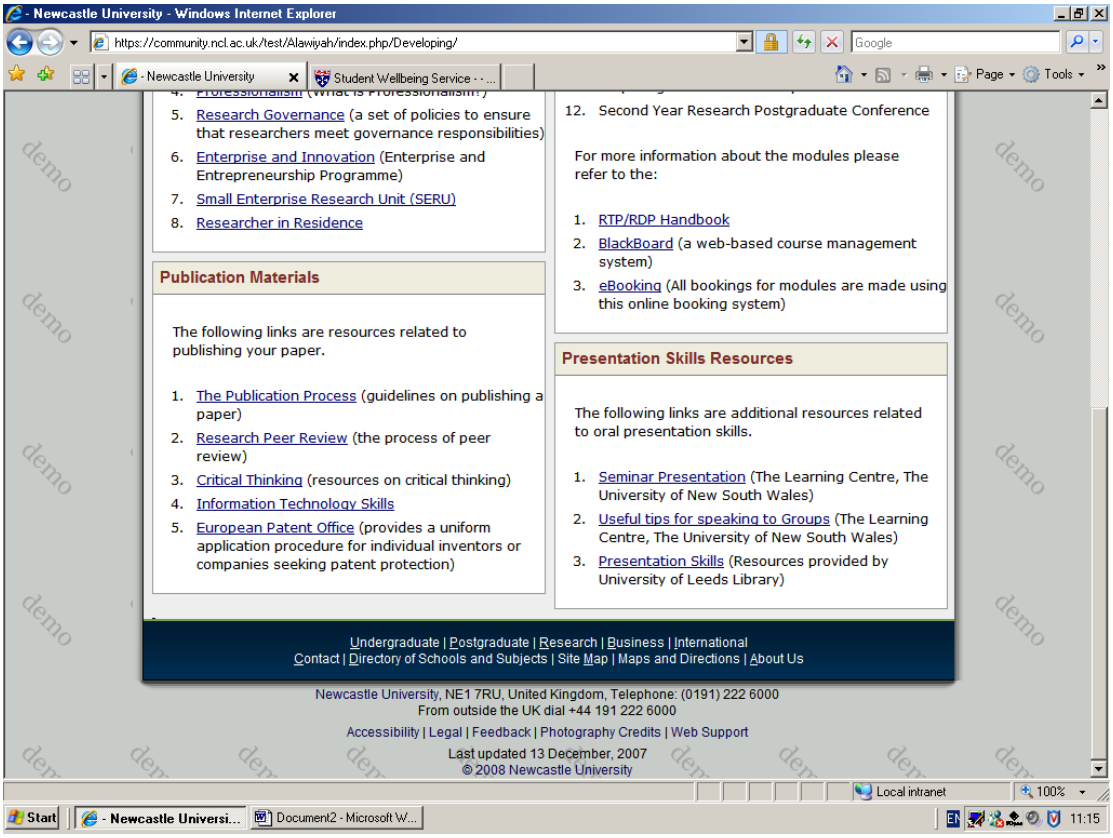
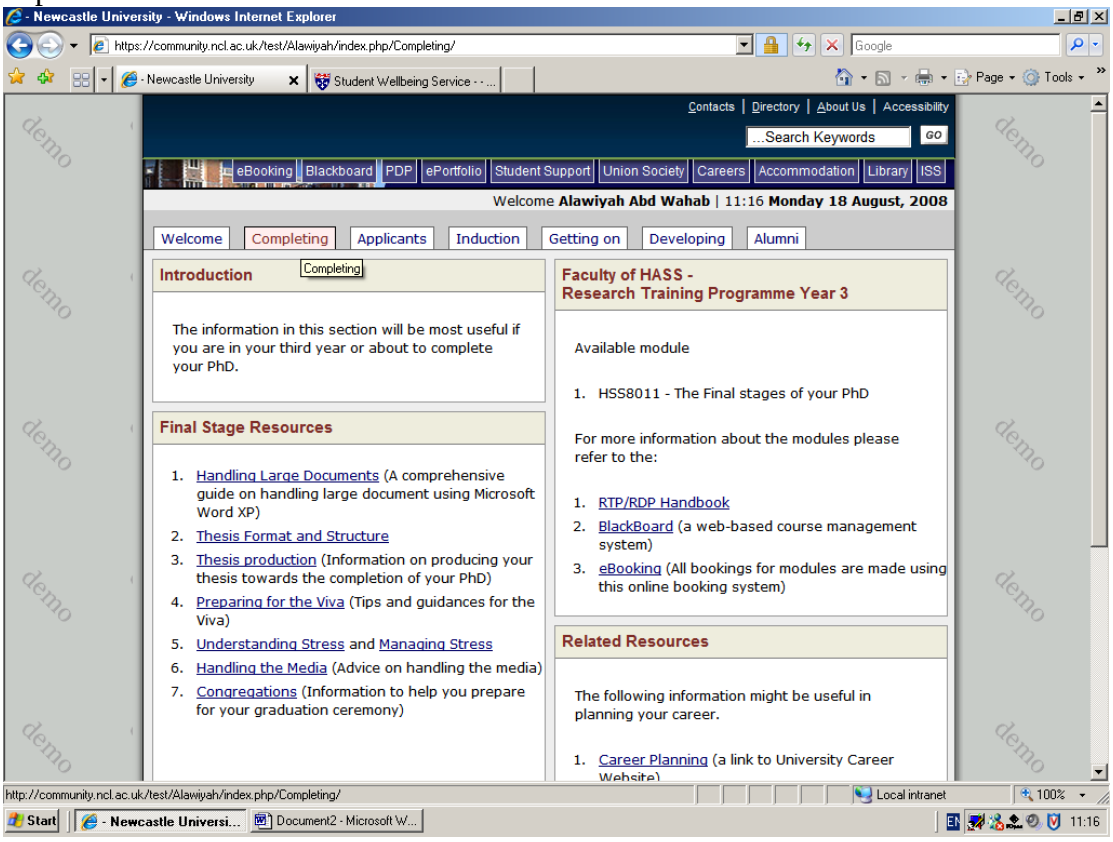


Completing

Top



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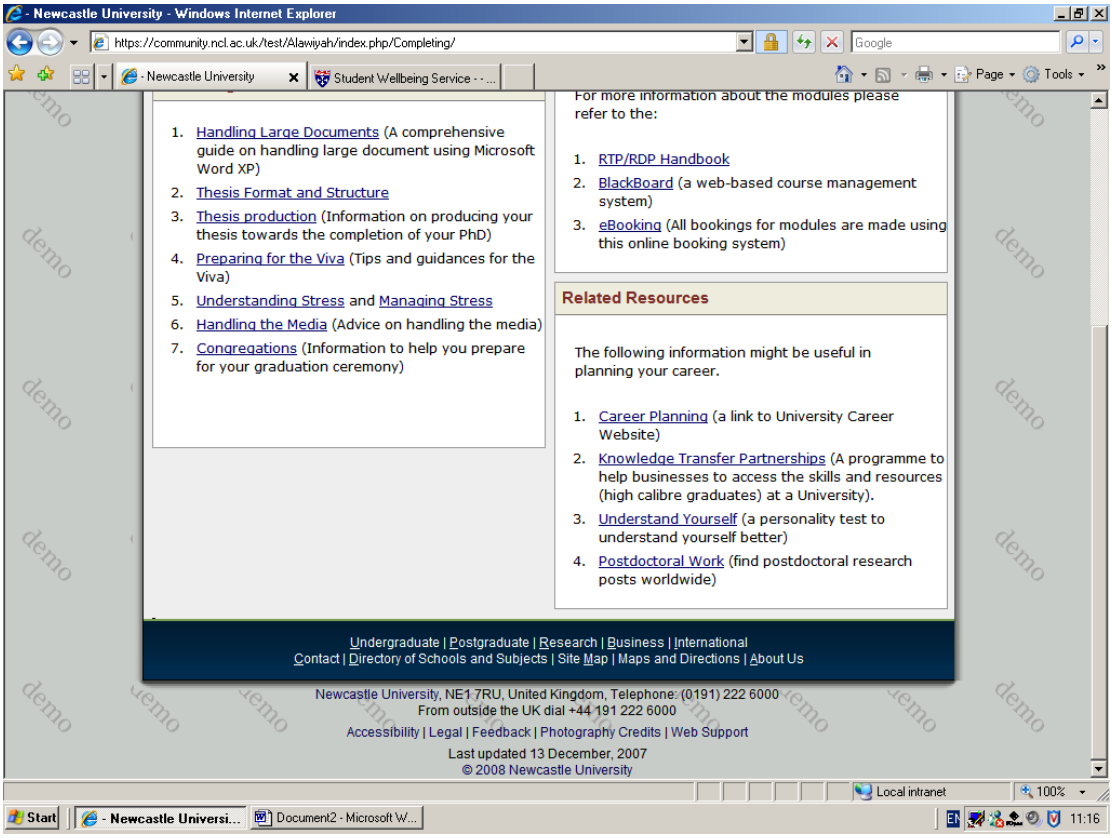
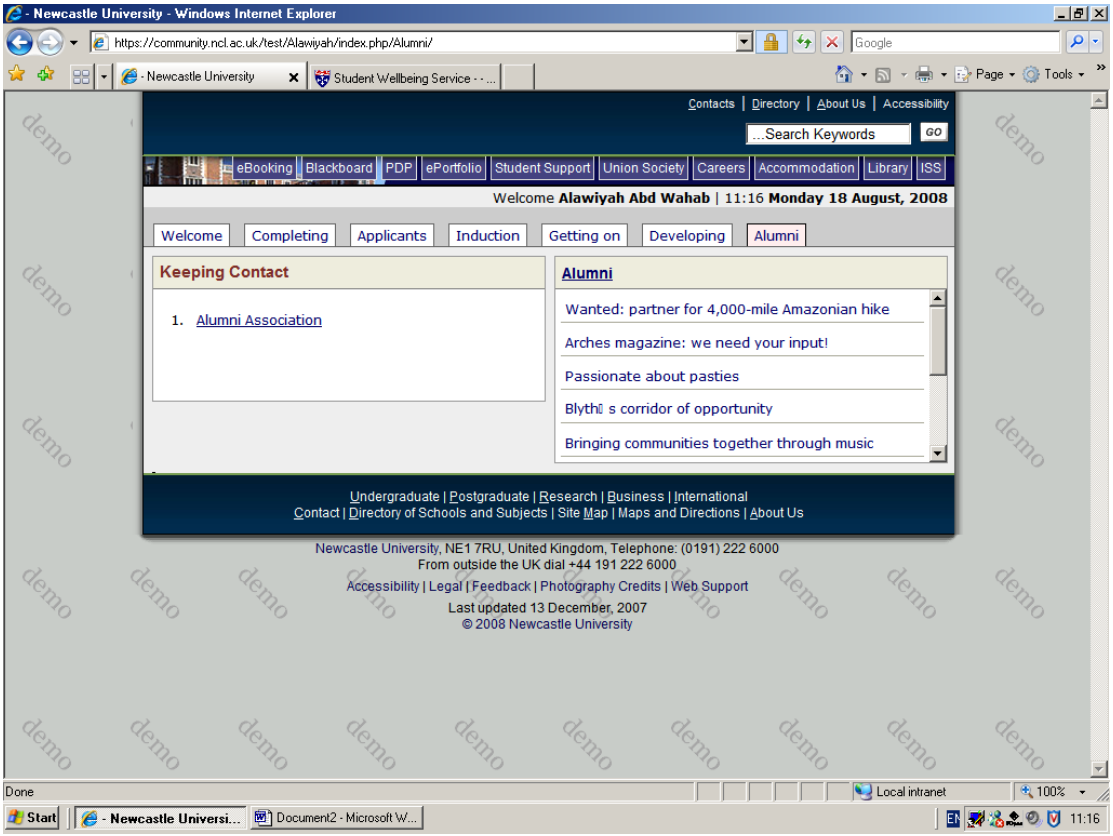
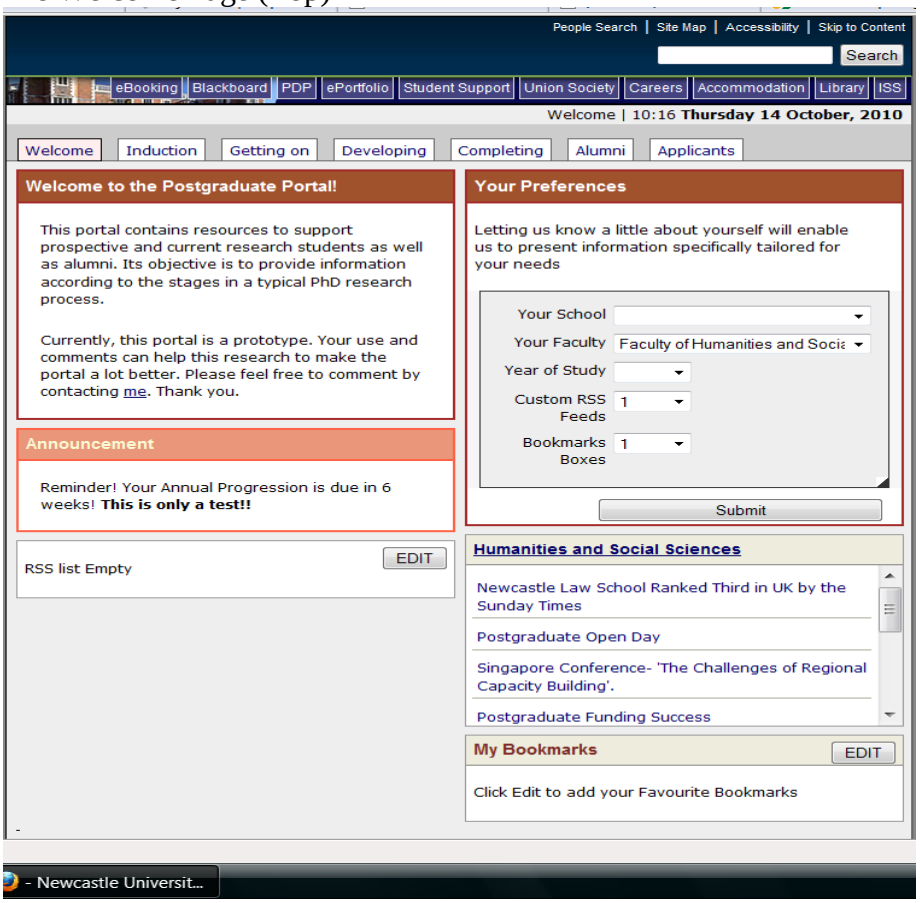


Alumni

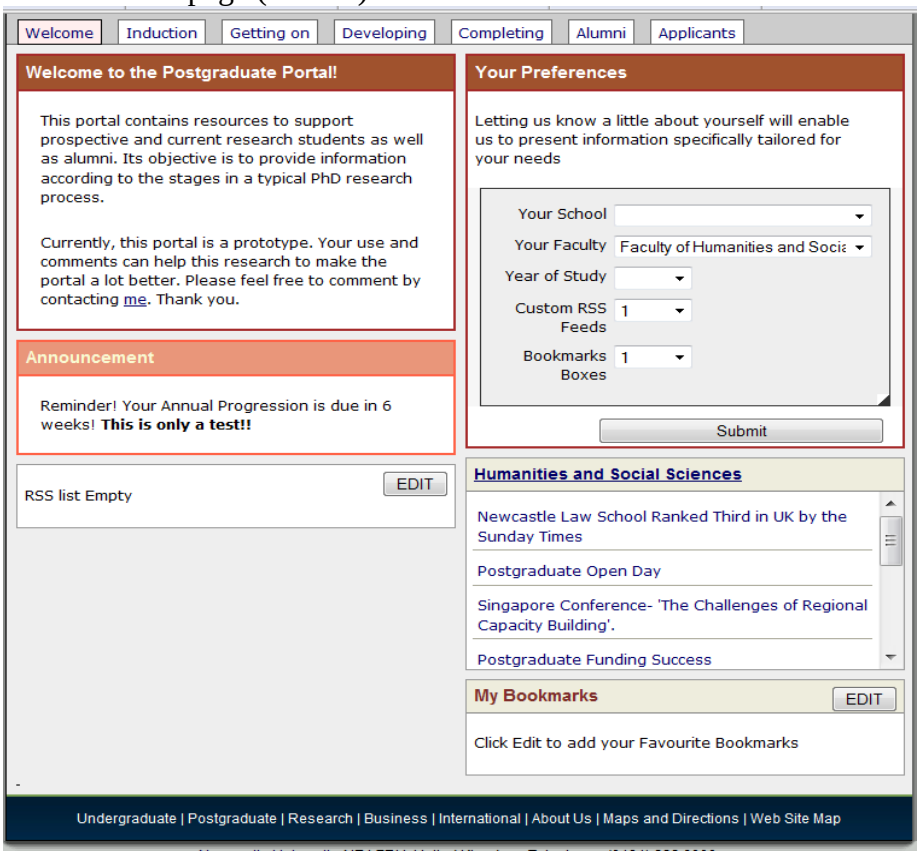


Appendix N The final Prototype Portal

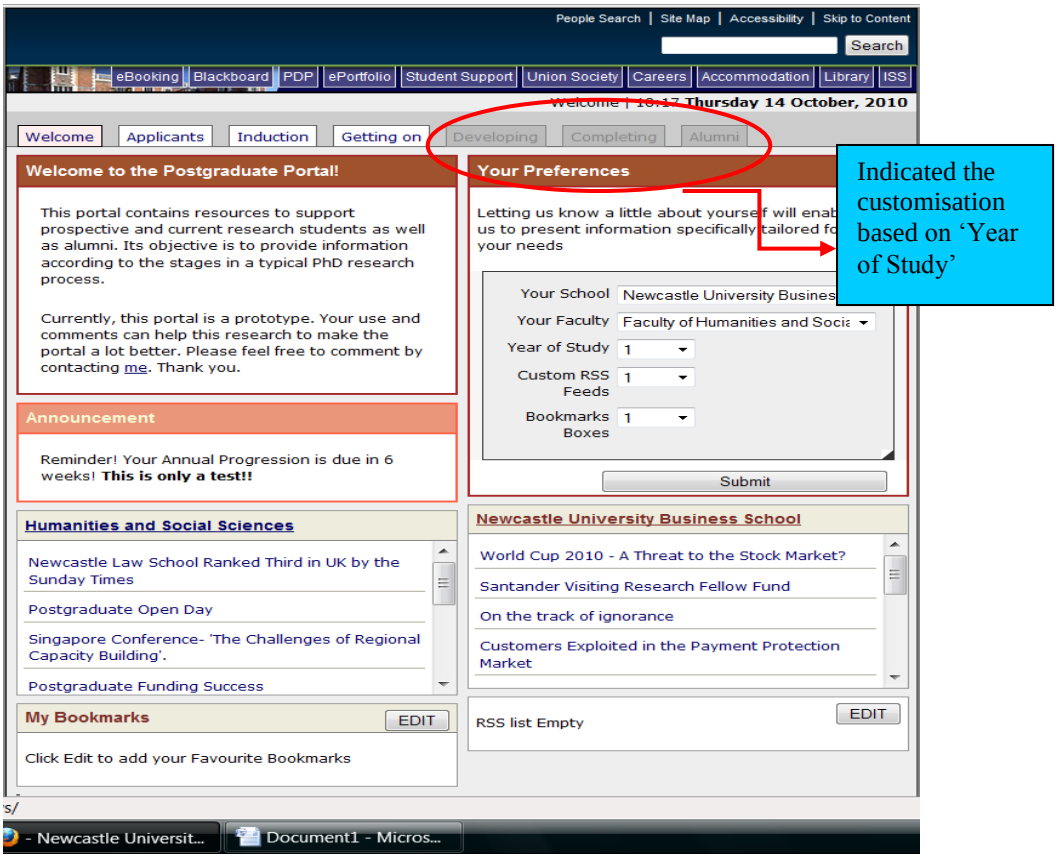
The Welcome Page (Top)



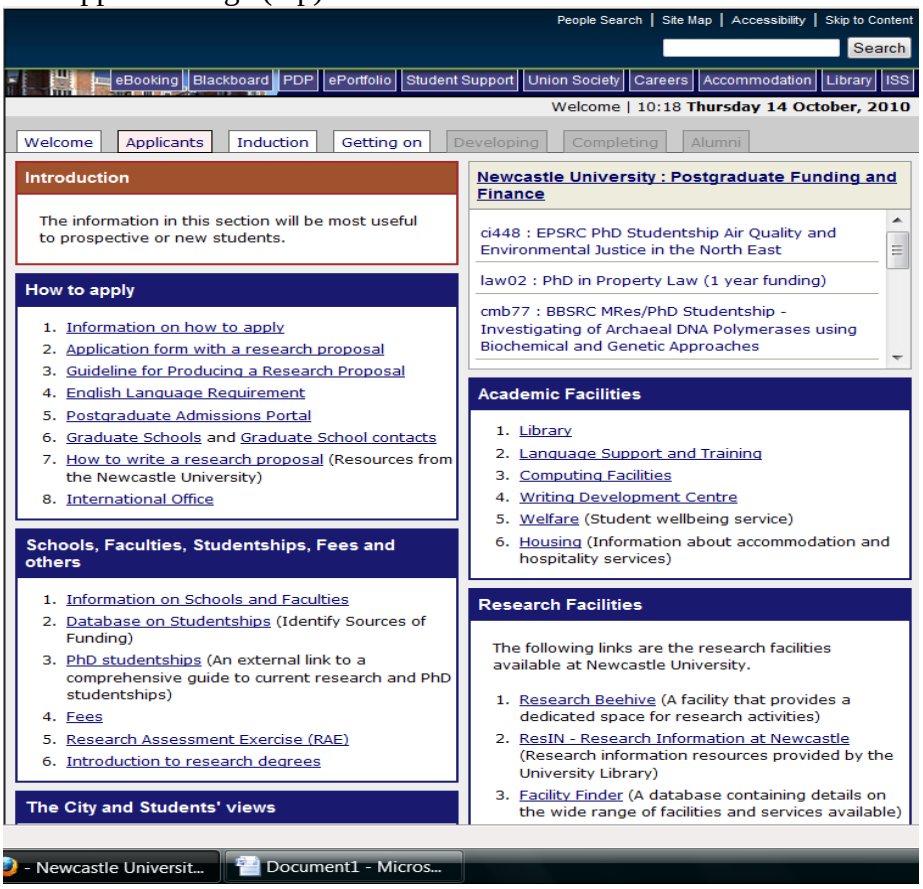
The Welcome page (bottom)



The Welcome Page with "Your Preferences" portlet filled

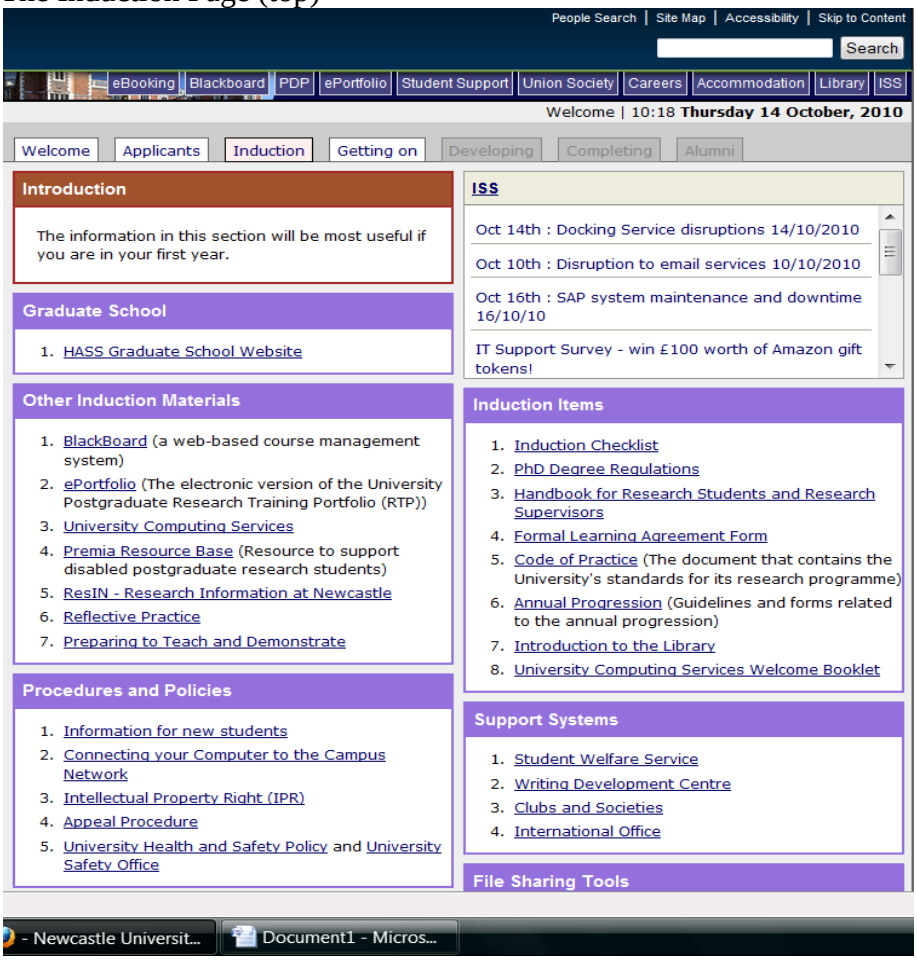


The Applicant Page (top)

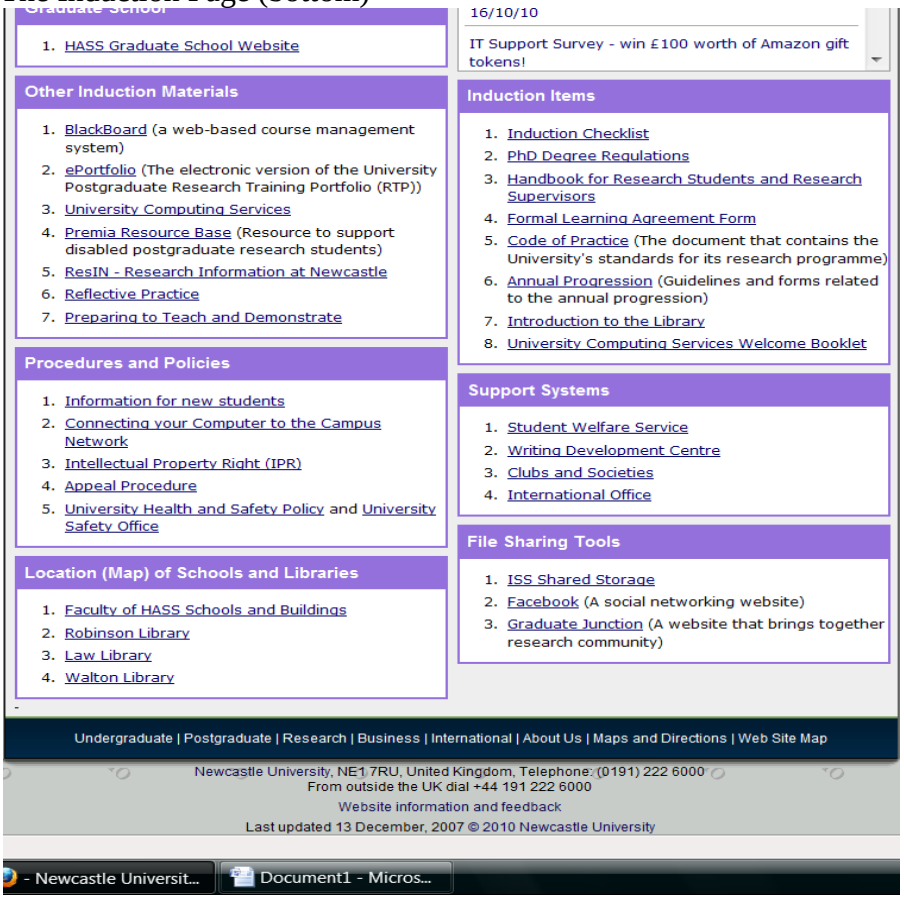


The Applicant Page (bottom)

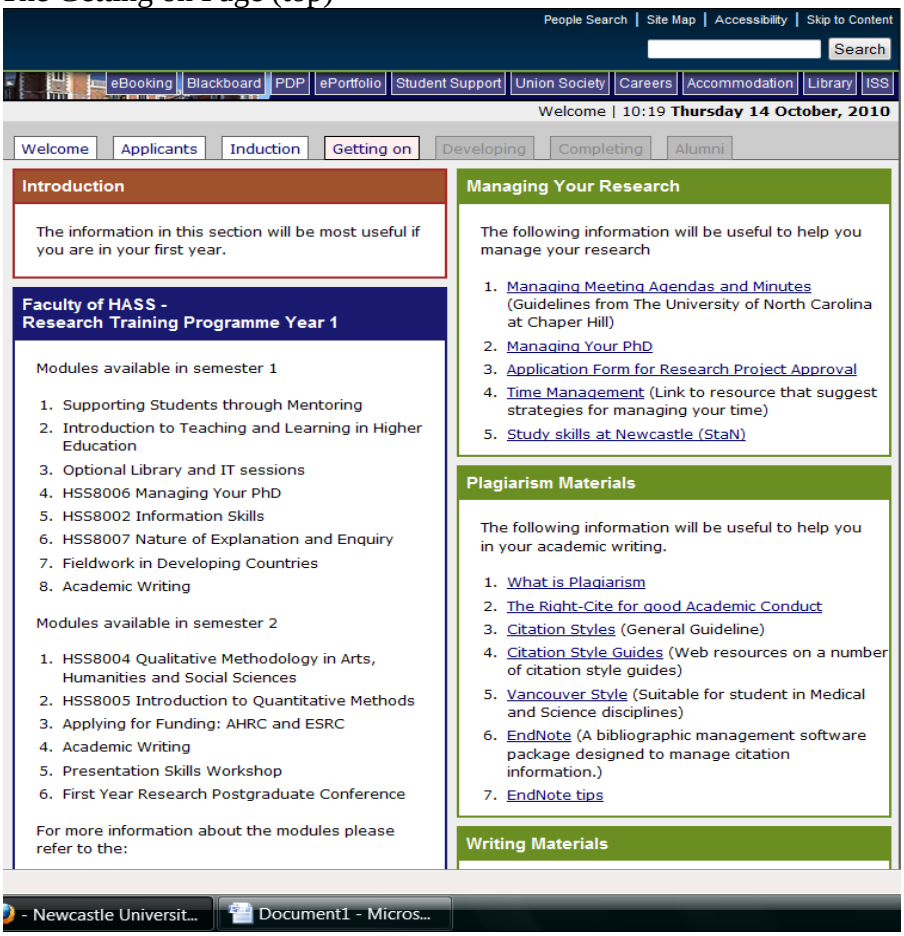
The Induction Page (top)



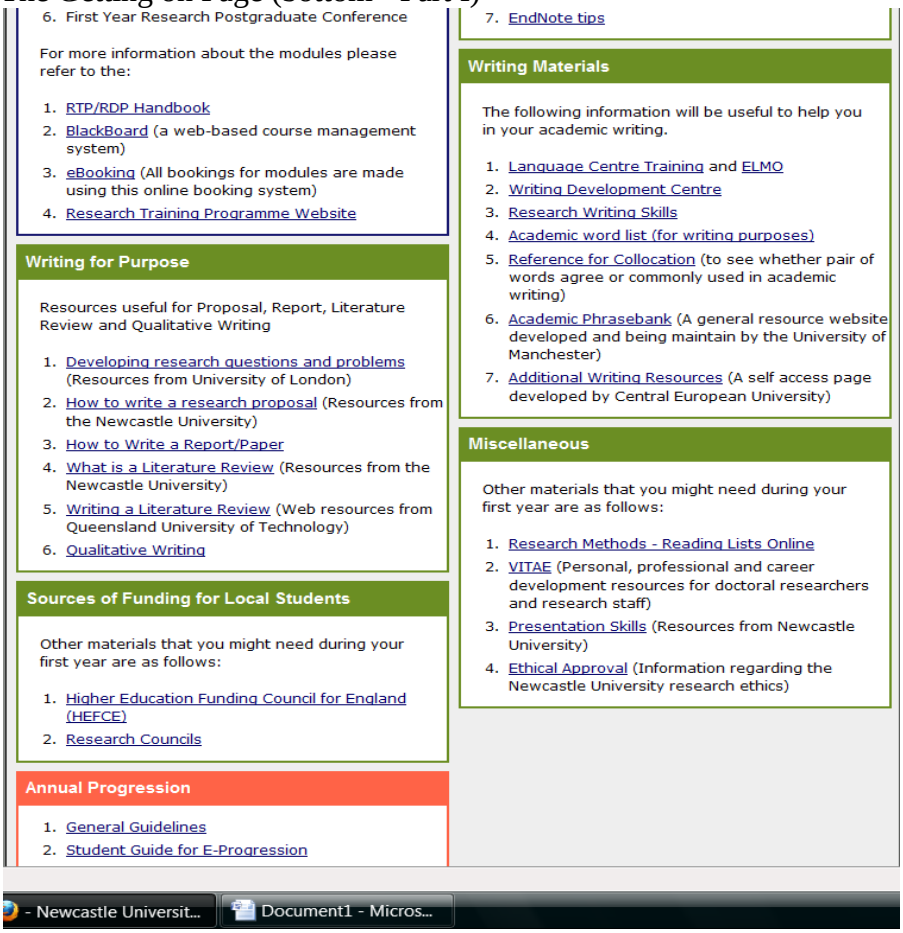
The Induction Page (bottom)



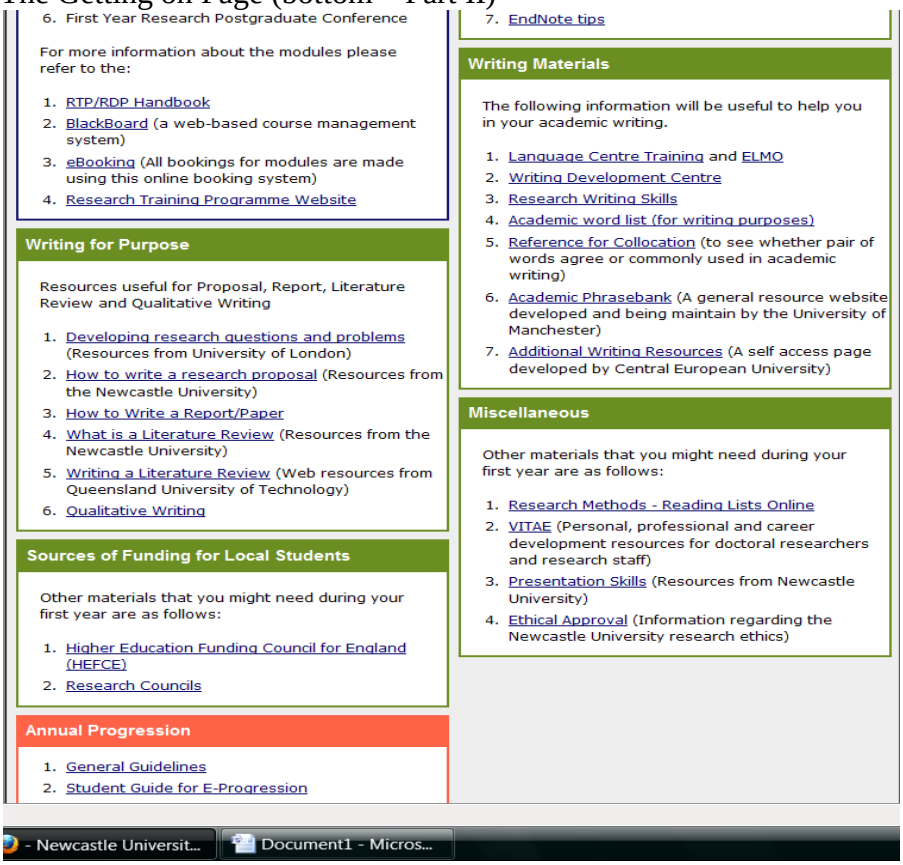
The Getting on Page (top)



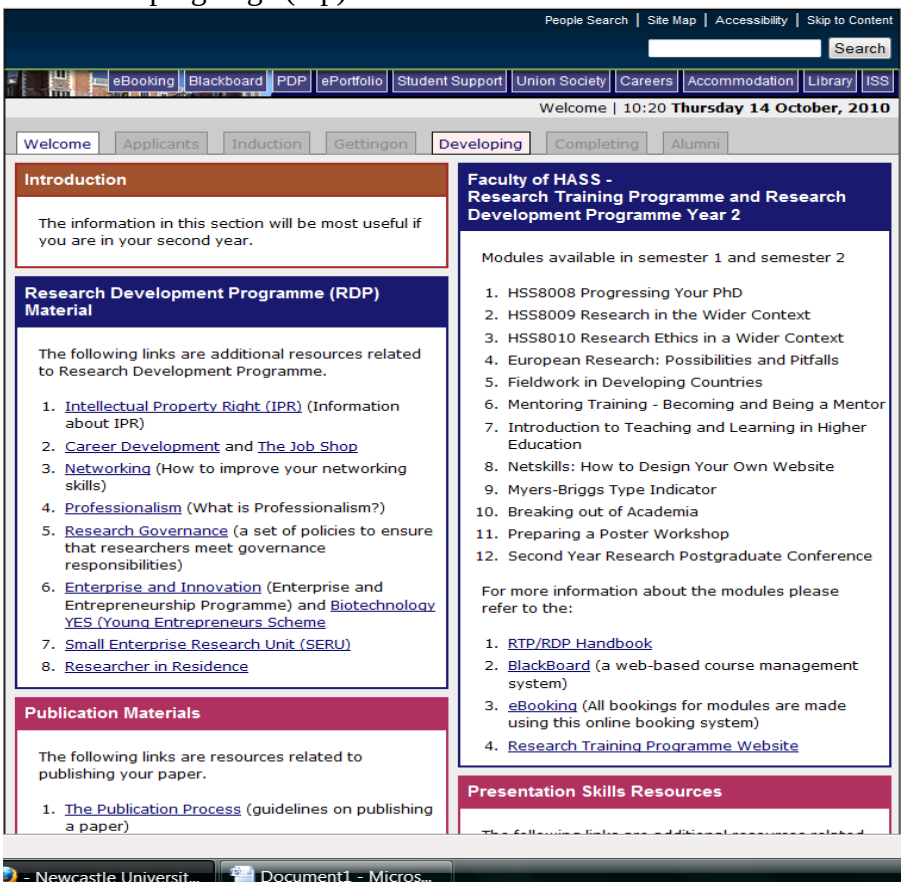
The Getting on Page (bottom - Part I)



The Getting on Page (bottom – Part II)

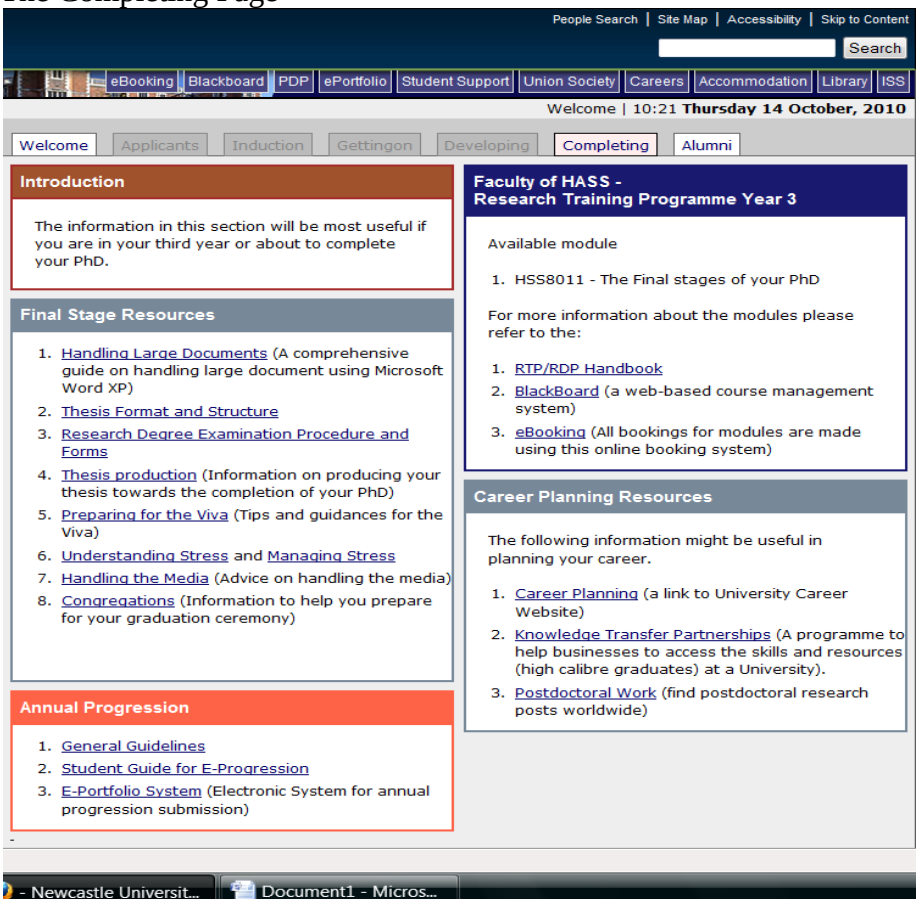


The Developing Page (top)

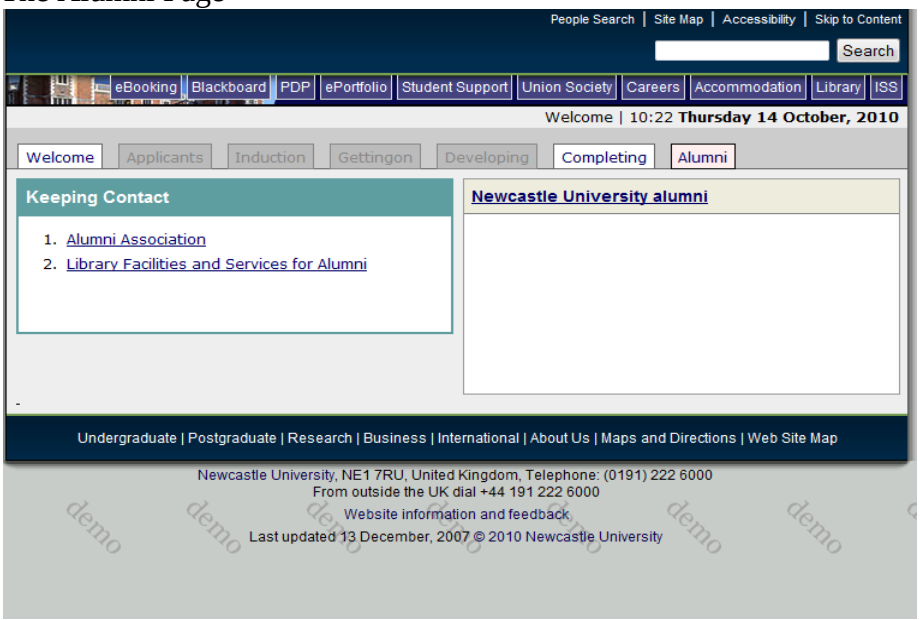


The Developing Page (bottom)

The Completing Page



The Alumni Page



Appendix O List of Research Students' Information Requirements

The Applicant Page

Applicant Stage	Description of Link
How to apply	
	Information on how to apply
	Application form with a research proposal
	Guideline for producing a research proposal
	English Language Requirement
	Postgraduate Admissions Portal
	Graduate Schools
	Graduate School contacts
	How to write a research proposal
	International Office
Academic Facilities	
	Library
	Language Support and Training
	Computing Facilities
	Writing Development Centre
	Welfare
	Housing
Schools, Faculties, Studentships, Fees and others	
	Information on Schools and Faculties
	Database on Studentships
	Fees
	Research Assessment Exercise
	Introduction to Research Degrees
Research Facilities	
	Research Beehive
	ResIN (Research Information at Newcastle)
	Facility Finder
	Museums and Galleries and Cultural Facilities
	Scientific Facilities
	Farms and Botanical Gardens
	Observatory
The City and Students' views	
	City Life
	Student Life
	Students' Testimonial
	Living cost
	Pre-arrival Information

The Induction Page

Induction Stage	Description of link
Graduate School	
	HASS Graduate School Website
Induction Items	
	Induction checklist
	PhD degree regulation
	Handbook for research students and research supervisors
	Formal learning agreement form
	Code of practice
	Annual progression
	Introduction to the library
	University computing services welcome booklet
Other Induction Materials	
	BlackBoard
	ePortfolio
	University computing services
	Premia resource base
	ResIN
	Reflective Practice
	Preparing to teach and demonstrate
Procedures and Policies	
	Information for new students
	Connecting your computer to the campus network
	Intellectual property right
	Appeal procedure
	University health and safety policy
	University safety office
Support Systems	
	Student welfare service
	Writing development centre
	Clubs and societies
	International office
File Sharing Tools	
	ISS shared storage
	Facebook
	Graduate Junction
Location (map) of schools and libraries	
	Faculty of HASS schools and buildings
	Robinson library
	Law library
	Walton library

The Getting on Page

Getting On Stage	Description of link
Managing Your Research	
	Managing meeting agendas and minutes
	Managing your PhD
	Application form for research project approval
	Time management
	Study skills at Newcastle
Plagiarism Materials	
	What is Plagiarism
	The right-cite for good academic conduct
	Citation styles
	Citation style guides
	Vancouver style
	EndNote
	EndNote tips
Writing Materials	
	Language centre training
	ELMO
	Writing development centre
	Research writing skills
	Academic word list
	Reference for collocation
	Academic Phrasebank
	Additional writing resources
Writing for Purpose	
	Developing research questions and problems
	How to write a research proposal
	How to write a report/paper
	What is a literature review
	Writing a literature review
	Qualitative writing
Sources of funding for local students	
	Higher Education Funding Council for England (HEFCE)
	Research councils
Annual Progression	
	General guidelines
	Student guide for e-progression
	e-Portfolio system
Miscellaneous	
	Research methods – reading lists online
	VITEA
	Presentation skills
	Ethical approval

The Developing Page

Developing Stage	Description of Link
Research Development Programme (RDO) Material	
	Intellectual Property Right (IPR)
	Career development
	The job shop
	Networking
	Professionalism
	Research governance
	Enterprise and innovation
	Biotechnology YES
	Small Enterprise Research Unit
	Researcher in residence
Publication Materials	
	The publication process
	Research peer review
	Conference alerts
	Critical thinking
	Information technology skills
	European patent office
Presentation Skill Resources	
	Seminar presentation
	Useful tips for speaking to groups
	Presentation skills
Project Management Resources	
	Project management at London School of Economic
	Project management tools
	Microsoft office project
Annual Progression	
	General guidelines
	Student guide for e-progression
	e-Portfolio system

The Completing Page

Completing Stage	Description of link
Final Stage Resources	
	Handling large documents
	Thesis format and structure
	Research degree examination procedure and forms
	Thesis production
	Preparing for the viva
	Understanding the stress
	Managing the stress
	Handling the media
	Congregation
Career Planning Resources	
	Career planning
	Knowledge transfer partnerships
	Postdoctoral works
Annual Progression	
	General guidelines
	Student guide for e-progression
	e-Portfolio system

The Alumni Page

Alumni Stage	
Keeping Contact	
	Description of link
	Alumni association
	Library facilities and services for alumni

Appendix P The Final Version of Web Portal

Personalisation - RSS Feeds Feature

The RSS feature is a part of the news system. This is where a user can choose the feeds that they want to display within the portal. At the beginning of the development, the users can choose up to four RSS feeds. However, after the feedback from the focus groups, the users were given a choice of how many RSS feeds that they want to display in the portal. The reason for this was that some of the users expressed the need for only one feed but others wanted more than one feed. However, it was decided that a maximum of four feeds would be provided by the portal. If more feeds were allowed, the portal interface would not comply with accessibility rules. This meant that there would be problems in navigating the portal, because the portal interface would be long, and the users would need to scroll down before they could read their feeds.

Personalisation - Bookmark Features

This feature enabled users to choose how many bookmark boxes they wanted to appear on their portal interface as well as what kind of favourite links they wanted to save. The justification of having more than one bookmark box was that the users could categorise their favourite links. A student may have wanted to have one bookmark box to save links related to their research and one bookmark box that saved links related to their personal interests. The users were also given a choice of having up to four bookmark boxes within the portal. This was again due to accessibility requirements.

Customisation

Customisation features included the ability of the portal to display only relevant information resources to users. The term ‘portlet’ is used to refer to “a small window on a portal page” (PC Magazine, 2008). The ‘Your Preferences’ portlet enabled users to choose their school, faculty, year of study, the number of RSS boxes and bookmark boxes from the drop down lists, as shown is figure 21.

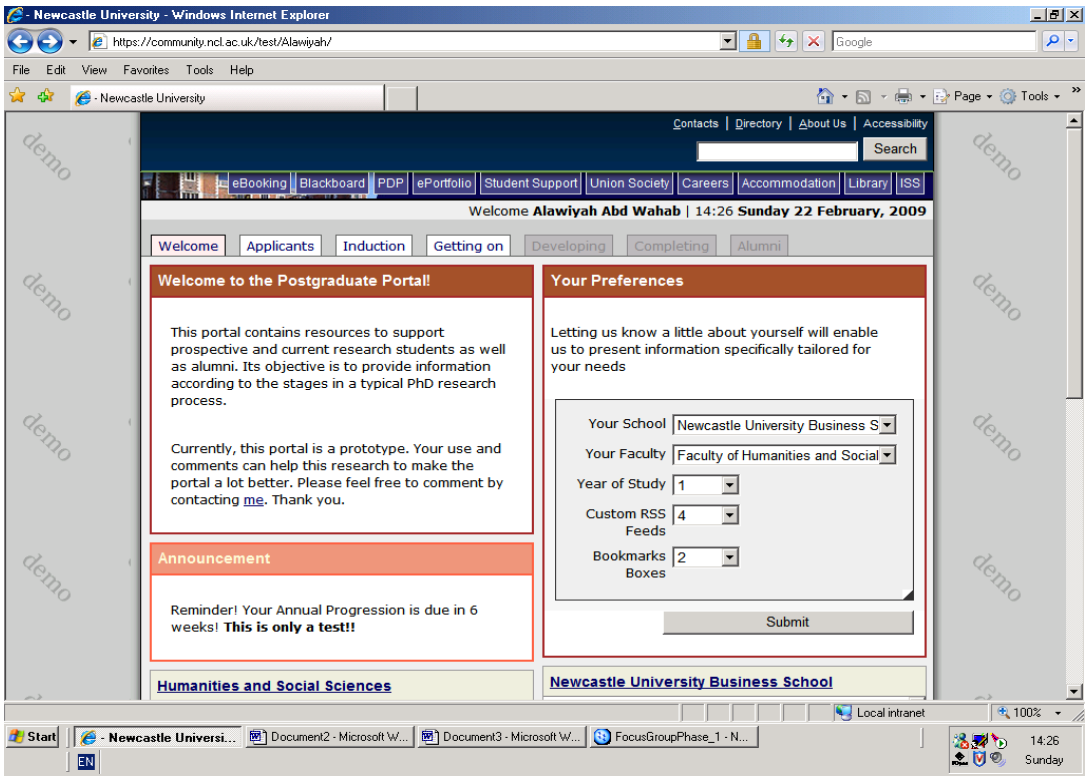


Figure 21 – The Welcome page showing the 'Your Preference' portlet

The 'Your School' and 'Your Faculty' input fields prompted users to select their school and faculty from the drop-down list, in order that relevant news or events from the school and faculty be displayed on the portal. For example, if a user selected the 'Newcastle University Business School' from the drop down list, the syndicated news from the Business school would be displayed, as shown in figure 22.

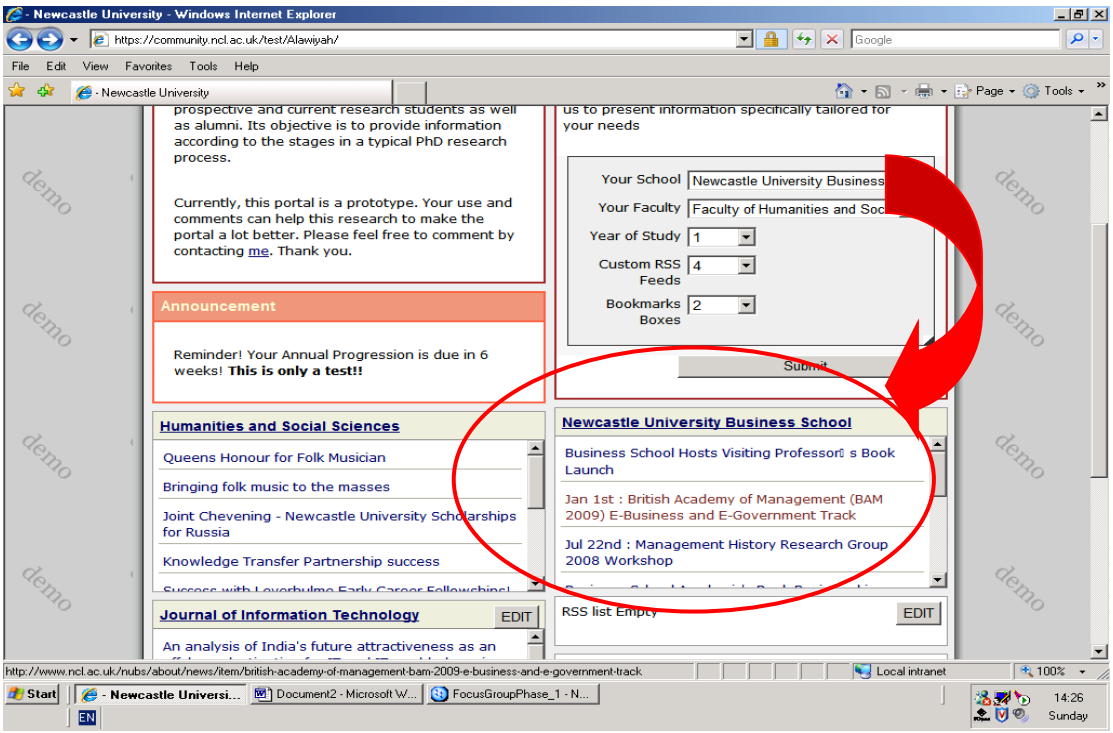


Figure 22 – News or events from chosen school is displayed

If a user chose the 'Faculty of Humanities and Social Science' from the drop down list, relevant news or events would be displayed as shown in figure 23.

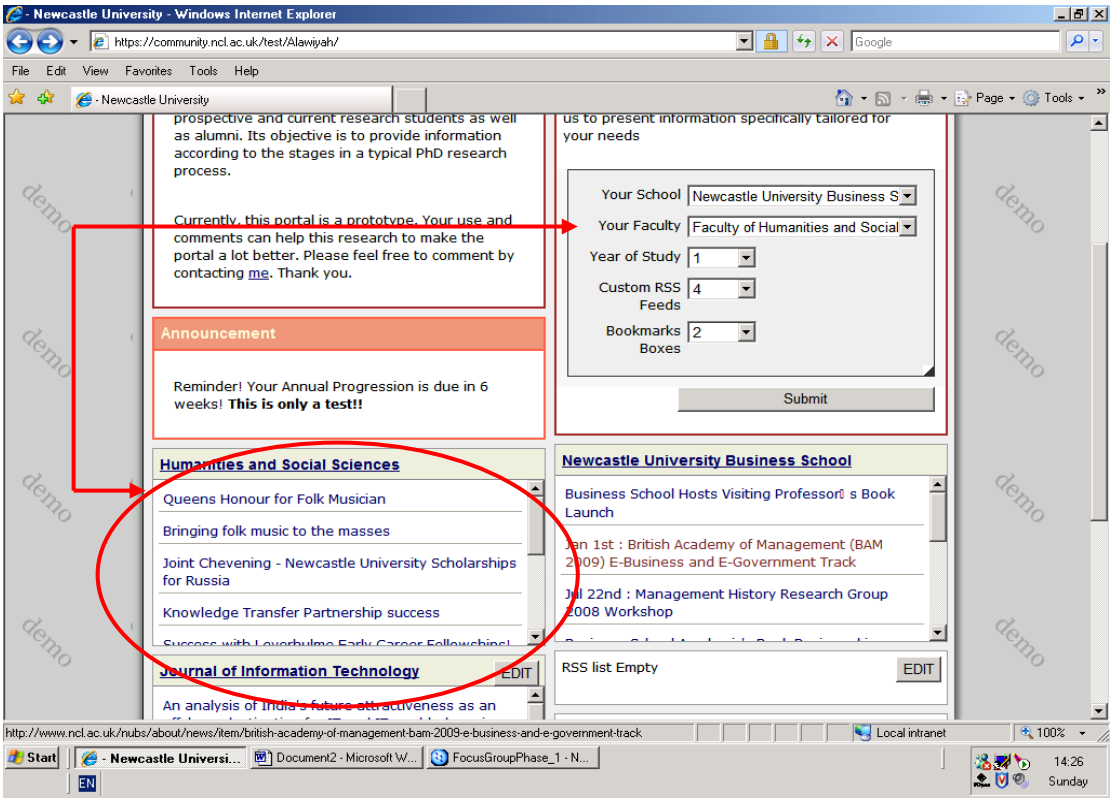


Figure 23 – News or events from the faculty chosen

Accordingly, figure 24, figure 25 and figure 26 show the relevant training programme modules, graduate school contacts and the libraries' and academic buildings' location displayed when the 'Faculty of Humanities and Social Sciences' was chosen.

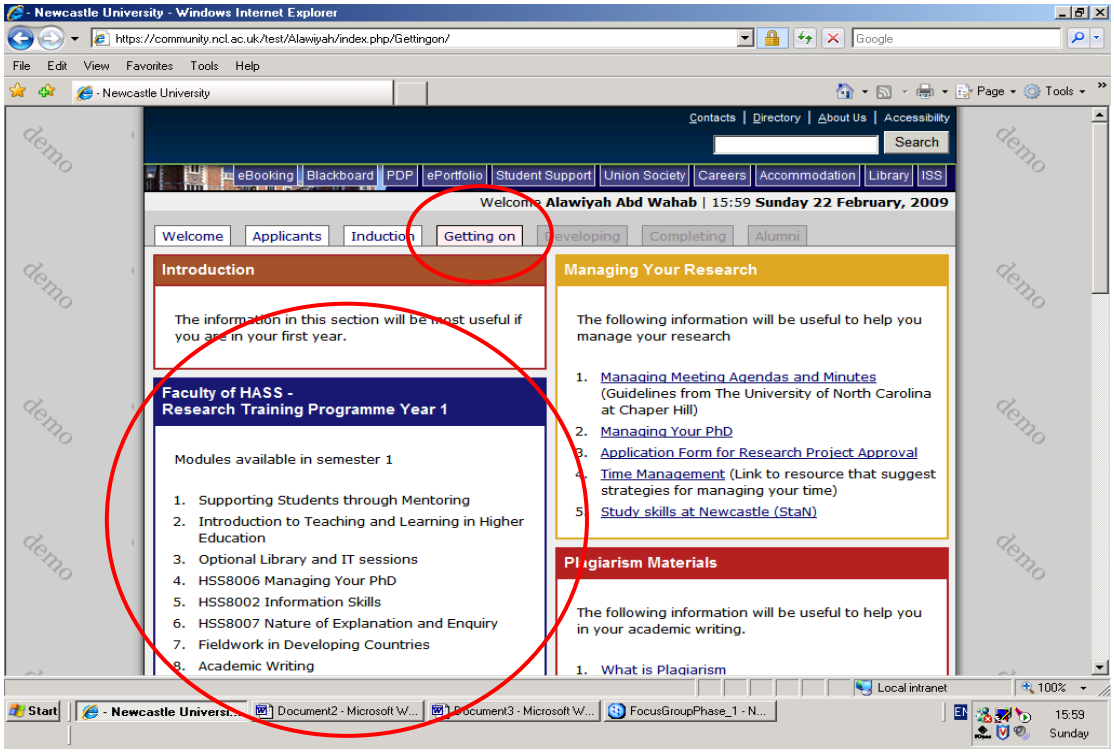


Figure 24 – Research Training Modules for the Faculty of HASS

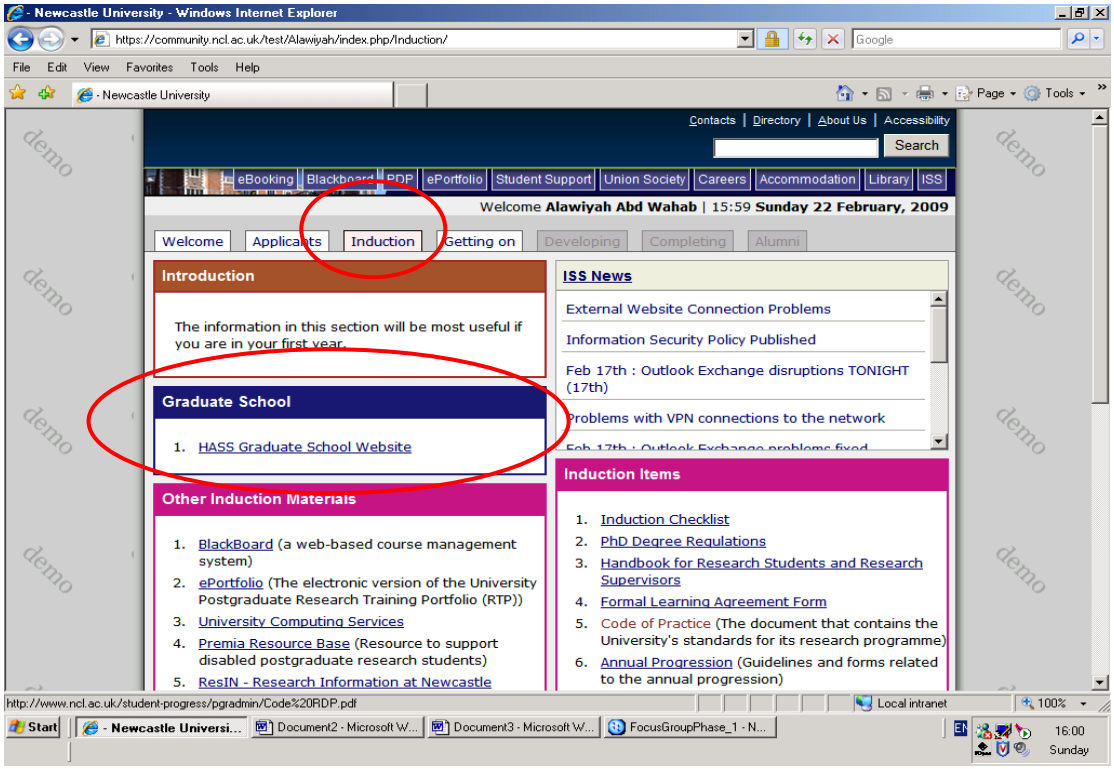


Figure 25 – The Graduate School website

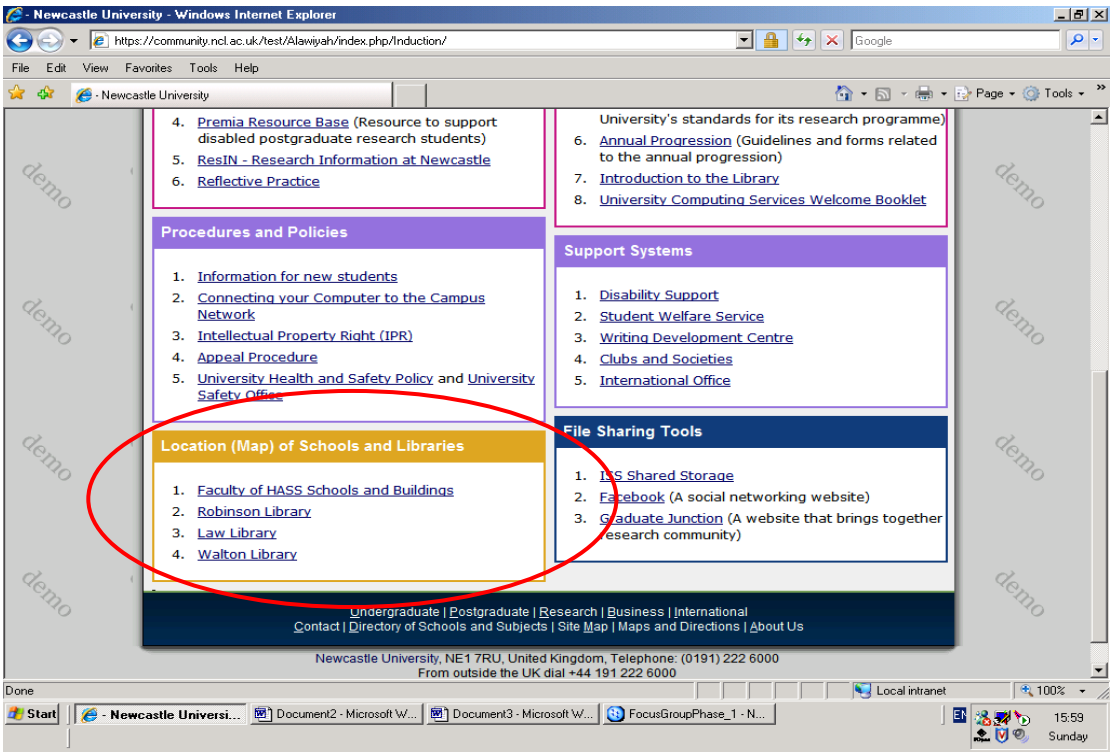


Figure 26 – The location of libraries and academic buildings

The 'Year of Study' input field prompted users to input their year of study in order that relevant menu tabs to be displayed. If a user chose '1', the portal would display 'Induction' and 'Getting on' menu tabs whilst disabling 'Developing', 'Completing' and 'Alumni' menu tabs as shown in figure 27.

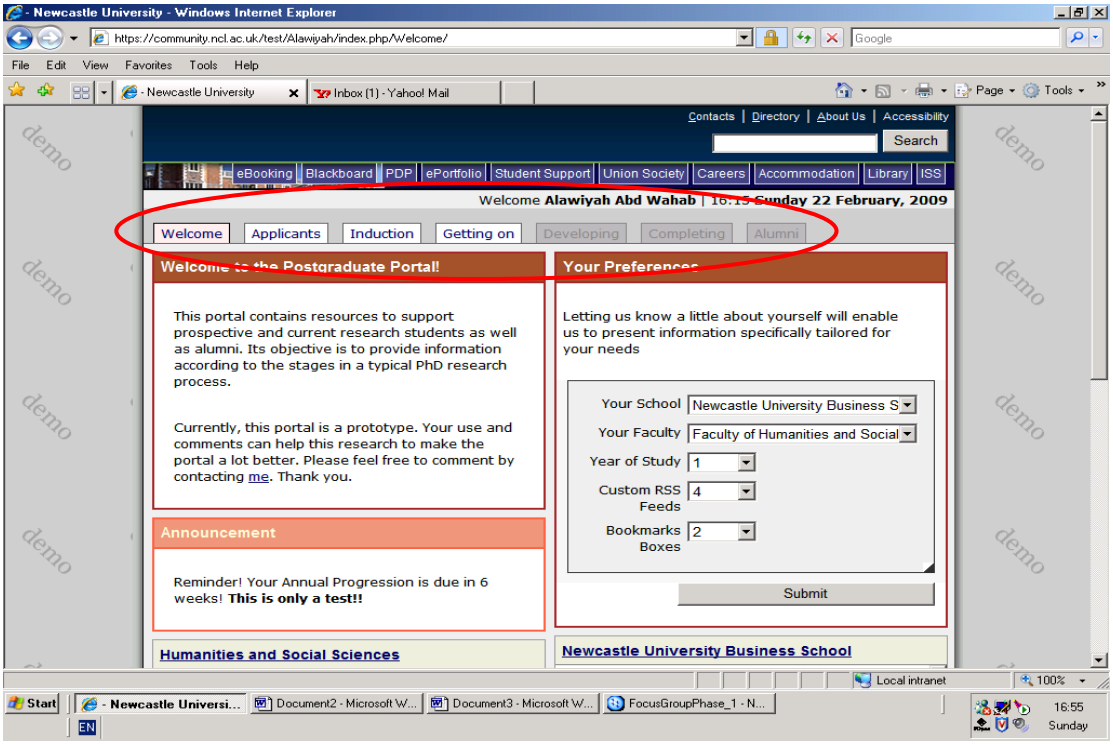


Figure 27 – The menu tabs according to 'Year of Study'

Both the ‘RSS’ and ‘Bookmark’ boxes input fields prompted users to choose the number of RSS and Bookmark boxes they wanted to be displayed within the ‘Welcome’ page. For example, is a user chose ‘4’ custom RSS feeds and ‘2’ bookmark boxes, then the portal would display 4 RSS feeds and 2 bookmark boxes as shown in figure 28.

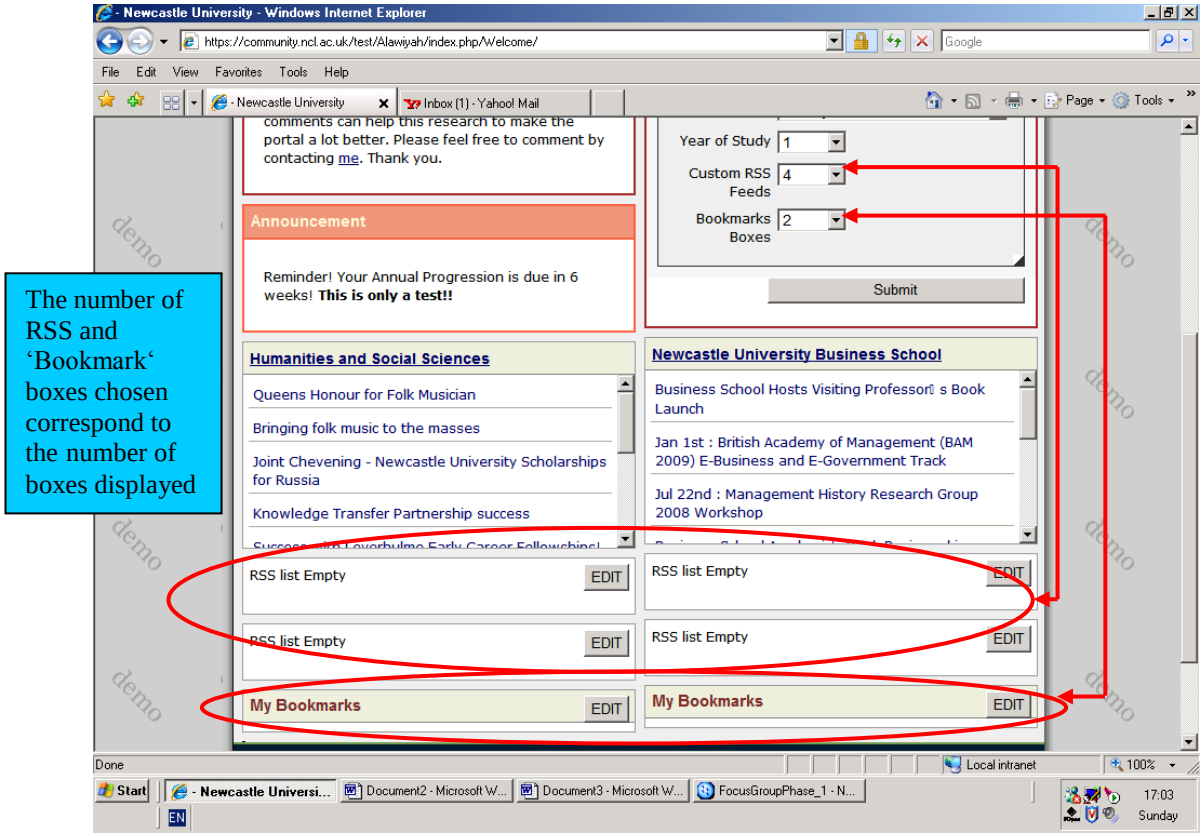


Figure 28 – The number of RSS and Bookmark boxes is displayed based upon user inputs

The customisation feature is quite flexible, whereby users are encouraged to define their requirements so that they can access information and the resources they need, while it still gives them the opportunity to browse the entire site if or when they wish to.

The Portal’s Contents

This section discusses in detail the content of the final prototype portal. The portal contains hyperlinks to internal as well as external resources. The decision to include which links within the portal was based on the findings from the analysis of relevant research degree documents, consultation with research training directors and library web pages, as well as feedback from focus group discussion and interviews. The hyperlinks were chosen from existing initiatives available from other website and resources relevant to the research portal. For example:

- To illustrate information about accommodation, the case university accommodation website (http://www.ncl.ac.uk/accommodation/) was chosen;
- To illustrate information about a guide to qualitative writing, a resource developed as a result from a research project (http://www.dur.ac.uk/writingacrossboundaries/) was used; and
- To illustrate information about external funding resources, the research council website (http://www.rcuk.ac.uk/default.htm) was linked in the prototype research portal.

In short, all the links which illustrated information resources which were included in the prototype were adopted from other initiatives. It was believed that for the purpose of just illustrating the information resources, it would be more convenient and beneficial to simply adopt existing resources. This was convenient, in the sense that it would save time and resources, and be beneficial in that the portal could collect and categories existing resources into one place, thus promoting them to the students. However, as reported in Chapter 6, the findings show that research students would prefer a tailored information resource, rather than a general one.

The discussion of the portal's content follows the content structure within the portal. The portal is divided into several tab menus, including the 'Application', 'Induction', 'Getting on', 'Developing', 'Completing' and 'Alumni' menu tabs. Each of these is discussed below.

Applicants Tab

The 'Applicants' tab consists of several portlets hosting several HTML fragments that contain relevant hyperlinks. This tab is targeted to the prospective research students. However, during the development of the portal, issues of accessibility by prospective students were widely debated by the focus groups and interview participants. As the 'Applicant' tab was hosted within the portal, only users registered as students or staff at the case University were allowed to access it. The question then was how prospective students would be able to access it. Since the purpose of including the 'Applicants' tab within the portal was only to gain user feedback on its content, the question of its accessibility was fed back to the development team. Furthermore, the decision about this was a technical matter. Thus, it was not dealt with at this stage. However, the developer should be aware of this issue if the research portal is to be made generally available.

There are six HTML fragment portlets and one RSS portlet within the ‘Application’ tab. The portlets are arranged in two columns from left to right. The HTML portlets contain: (1) introduction to the tab content and explanation of the intended year of study for the tab’s content; (2) links related to the information on how to apply; (3) links related to academic facilities; (4) links related to academic departments, internal and external studentships, fees, research assessment exercise and introduction to research degrees websites; (5) links related to research facilities; and (6) links relevant to the surrounding area of the case University’s city. The RSS portlet contains RSS news feed from the case university’s postgraduate funding and finance pages.

Table 30 shows the list of links and sources within the Applicant tab selected for the purposes of this study. It should be noted that some of the websites might now be outdated and missing from the appropriate servers.

Applicant	
Description of Link	**Sources**
How to Apply	
Information on how to apply	http://www.ncl.ac.uk/postgraduate/apply/
Application form with a research proposal	http://www.ncl.ac.uk/postgraduate/apply/applicationforms.phtml
Guideline for producing a research proposal	http://www.ncl.ac.uk/hss/postgrad/research/Guidelines.pdf
English Language Requirement	http://www.ncl.ac.uk/postgraduate/international/englishlanguage/index.htm
Postgraduate Admissions Portal	http://www.ncl.ac.uk/postgraduate/apply/form/
Graduate Schools	http://www.ncl.ac.uk/postgraduate/life/gradsch.htm
Graduate School contacts	http://www.ncl.ac.uk/postgraduate/apply/graduate_schools.htm
How to write a research proposal	http://www.unisanet.unisa.edu.au/learningconnection/student/research/proposal.asp
International Office	http://www.ncl.ac.uk/international/
Academic Facilities	
Library	http://www.ncl.ac.uk/library/
Language Support and Training	http://www.ncl.ac.uk/postgraduate/international/englishlanguage/englishsupport.phtml
Computing Facilities	http://www.ncl.ac.uk/iss/
Writing Development Centre	http://www.ncl.ac.uk/students/wdc/
Welfare	http://www.ncl.ac.uk/student-support/
Housing	http://www.ncl.ac.uk/accommodation/
Schools, Faculties, Studentships, Fees and others	
Information on Schools and Faculties	http://www.ncl.ac.uk/subjects/schools/
Database on Studentships	http://www.ncl.ac.uk/vacancies/studentships/
Fees	http://www.ncl.ac.uk/calendar/fees/database/
Research Assessment Exercise	http://www.ncl.ac.uk/postgraduate/welcome/research/rae.htm
Introduction to Research Degrees	http://www.ncl.ac.uk/postgraduate/research/types/
Research Facilities	
Research Beehive	http://www.ncl.ac.uk/business-directorate/facilities/beehive/
ResIN	http://www.ncl.ac.uk/library/resin/
Facility Finder	http://www.ncl.ac.uk/about/campus/facilities/list/
Museums and Galleries and Cultural Facilities	http://www.ncl.ac.uk/about/campus/facilities/list/Cultural+Facilities
Scientific Facilities	http://www.ncl.ac.uk/business/facilities/research/index.htm
Farms and Botanical Gardens	http://www.ncl.ac.uk/about/campus/facilities/list/Farms,+Field+Stations+and+Gardens
Observatory	http://www.ncl.ac.uk/about/campus/facilities/list/espin+observatory
The City and Students' views	
City Life	http://www.ncl.ac.uk/postgraduate/life/newcastle//index.htm
Student Life	http://www.ncl.ac.uk/postgraduate/life/
Students' Testimonial	http://www.ncl.ac.uk/postgraduate/students/profile/492
Living cost	http://www.ncl.ac.uk/postgraduate/funding/ukcost.htm
Pre-arrival Information	http://www.ncl.ac.uk/pre-arrival/

Table 30 - List of links and sources within the Applicant tab

Induction Tab

The ‘Induction’ tab contains eight HTML fragment portlets and one RSS portlet. The HTML portlets contain: (1) introduction to the tab content and explanation of the intended year of study for the tab’s content; (2) links to the graduate school; (3) links to items related to an induction sessions; (4) links to other induction items: (5) links related to policies and procedures for research degree programmes; (6) links related to support systems; (7) links related to file sharing tools; and (8) links related to location of the schools and libraries. The RSS portlet contains a news feed regarding the status of computing services managed by the computing centre.

Table 31 shows the list of links and sources within the Induction tab selected for the purposes of this study.

Induction	
Description of Link	**Sources**
Graduate School	
HASS Graduate School Website	http://www.ncl.ac.uk/hss/postgrad/
Induction Items	
Induction checklist	http://www.ncl.ac.uk/student-progress/pgradmin/Form%20A.pdf
PhD degree regulation	http://www.ncl.ac.uk/regulations/docs/2007/documents/Doctorate.pdf
Handbook for research students and research supervisors	http://www.ncl.ac.uk/student-progress/research-handbook/
Formal learning agreement form	http://www.ncl.ac.uk/student-progress/pgradmin/Final%20Learning%20Agreement.pdf
Code of practice	http://www.ncl.ac.uk/student-progress/pgradmin/Code%20RDP.pdf
Annual progression	http://www.ncl.ac.uk/student-progress/pgradmin/Annual_progression.html
Introduction to the library	http://www.ncl.ac.uk/library/about/welcome/
University computing services welcome booklet	http://www.ncl.ac.uk/iss/support/information/documents/%20Orientation%20handbooks/Booklet%20Student%20Welcome%20Sep07.pdf
Other Induction Materials	
BlackBoard	http://bb.ncl.ac.uk/
ePortfolio	https://pf-postgrad.ncl.ac.uk/eportfolio
University computing services	http://www.ncl.ac.uk/iss/
Premia resource base	http://www.premia.ac.uk/
ResIN	http://www.ncl.ac.uk/library/resin/
Reflective Practice	http://www.ukcle.ac.uk/resources/reflection/index.html
Preparing to teach and demonstrate	http://www.ncl.ac.uk/student-progress/postgrad/teaching.html
Procedures and Policies	
Information for new students	http://www.ncl.ac.uk/postgraduate/support/health.htm
Connecting your computer to the campus network	http://www.ncl.ac.uk/iss/files/documents/Connecting%20a%20computer/nc06%20Using%20your%20own%20computer%20at%20the%20University%20Aug08.pdf
Intellectual property right	http://www.ncl.ac.uk/business-directorate/commercialization/intellectual_property/whatisip.php
Appeal procedure	http://www.ncl.ac.uk/student-progress/procedures/academic_appeals_procedure.php
University health and safety policy	http://www.ncl.ac.uk/medi/restricted/safety/UniversitySafetyPolicyAug2004.pdf
University safety office	http://www.safety.ncl.ac.uk/
Support Systems	
Student welfare service	http://www.ncl.ac.uk/wellbeing-service/
Writing development centre	http://www.ncl.ac.uk/postgraduate/facilities/writing.htm
Clubs and societies	http://www.ncl.ac.uk/postgraduate/life/clubs.htm
International office	http://www.ncl.ac.uk/international/
File Sharing Tools	
ISS shared storage	http://www.ncl.ac.uk/iss/getstarted/storage/shared.php
Facebook	http://www.facebook.com/facebook
Graduate Junction	http://www.graduatejunction.com/
Location (map) of schools and libraries	
Faculty of HASS schools and buildings	http://www.ncl.ac.uk/travel/campus/schools.php?faculty=fhas
Robinson library	http://www.ncl.ac.uk/library/about/location/
Law library	http://www.ncl.ac.uk/library/about/location/law.php
Walton library	http://www.ncl.ac.uk/library/about/location/walton.php

Table 31 - List of links and sources within the Induction tab

Getting-On Tab

The 'Getting on' menu tab contains a number of research training portlets and seven common portlets. The number of research training portlets displayed on the 'Getting on' menu tab depends on the faculty input field. For the Faculty of HASS, only one research training portlet will be displayed, for the Faculty of SAgE, two research training portlets will be displayed and for the FMS, three research training portlets will be displayed. The research training portlets contain links that are related to the modules and systems that support the research training programme. The common portlets contain: (1) introduction to the tab content and explanation of the intended year of study for the tab's content; (2) links related to managing research; (3) links to materials related to plagiarism; (4 and 5) links related to supporting writing; (6) links related to annual progression; and (7) links related to other information that were identified as relevant to research students at the first stage of their research study.

Table 32 shows the list of links and sources within the Getting On tab, selected for the purposes of this study.

Getting On	
Description of Link	**Sources**
Managing Your Research	
Managing meeting agendas and minutes	http://ssw.unc.edu/cares/planningbasics/meetings-rev2.pdf
Managing your PhD	http://www.grad.ac.uk/cms/ShowPage/Home_page/Online_resources/Just_for_Postgrads/Managing_your_research/p!elkimeL
Application form for research project approval	http://www.ncl.ac.uk/students/progress/staff-resources/pg-research//documents/progectapproval.doc
Time management	http://www.lc.unsw.edu.au/onlib/time.html
Study skills at Newcastle	http://www.ncl.ac.uk/library/teaching/stan/
Plagiarism Materials	
What is Plagiarism	http://www.ncl.ac.uk/library/resin/writing_up/academic_integrity/plagiarism.php
The right-cite for good academic conduct	http://www.ncl.ac.uk/right-cite/
Citation styles	http://www.ncl.ac.uk/library/resin/writing_up/citation/styles.php
Citation style guides	http://www.ncl.ac.uk/library/resin/writing_up/citation/resources.php
Vancouver style	http://www.library.uq.edu.au/training/citation/vancouv.pdf
EndNote	http://www.ncl.ac.uk/library/teaching/endnote/
EndNote tips	http://www.ncl.ac.uk/library/teaching/endnote/tips/
Writing Materials	
Language centre training	http://www.ncl.ac.uk/langcen/index.htm
ELMO	http://www.ncl.ac.uk/langcen/facilities/elmo.htm
Writing development centre	http://www.ncl.ac.uk/postgraduate/facilities/writing.htm
Research writing skills	http://www.unisanet.unisa.edu.au/Resources/research-

	Education/research%20education/researchwrite/welcome.htm
Academic word list	http://language.massey.ac.nz/staff/awl/awlinfo.shtml
Reference for collocation	http://corpus.byu.edu/bnc/
Academic Phrasebank	http://www.phrasebank.manchester.ac.uk/
Additional writing resources	http://www.ceu.hu/writing/sfaccess.html
Writing for Purpose	
Developing research questions and problems	http://www.soas.ac.uk/research/rsp/resources/designphdproject/44692.pdf
How to write a research proposal	http://www.ncl.ac.uk/library/resin/getting_started/research_proposals/writing.php
How to write a report/paper	http://lorien.ncl.ac.uk/tskills/reports/repwrite.pdf
What is a literature review	http://www.ncl.ac.uk/library/resin/managing_information/literature_reviews/
Writing a literature review	http://www.library.qut.edu.au/learn/learnhow/literaturereview.jsp
Qualitative writing	http://www.dur.ac.uk/writingacrossboundaries/
Sources of funding for local students	
Higher Education Funding Council for England (HEFCE)	http://www.hefce.ac.uk/
Research councils	http://www.rcuk.ac.uk/default.htm
Annual Progression	
General guidelines	http://www.ncl.ac.uk/student-progress/pgradmin/documents/AnnualProgressionGuidelines.pdf
Student guide for e-progression	http://www.ncl.ac.uk/student-progress/pgradmin/documents/StudentguidetoE-Progression.doc
e-Portfolio system	https://pf-postgrad.ncl.ac.uk/eportfolio
Miscellaneous	
Research methods – reading lists online	https://reading.ncl.ac.uk/rl/displaylist?module=DBA1001
VITEA	http://www.vitae.ac.uk/1274/About-Researcher-portal.html
Presentation skills	http://lorien.ncl.ac.uk/ming/dept/Tips/present/present.htm
Ethical approval	http://www.ncl.ac.uk/business-directorate/policies/ethics/index.php

Table 32 - List of links and sources within the Getting On tab

Developing Tab

The ‘Developing’ menu tab contains research training portlets and five common portlets. The research training portlets in this menu tab contain similar links to the research training portlets in the ‘Getting on’ tab. However, it differs in terms of the information about the modules. In this menu tab, the modules displayed in these portlets are the modules relevant for the second stage of research students. The common portlets contain: (1) introduction to the content of the tab to the users; (2) links related to resources on presentation skills; (3) links to information resources that support the research development programmes; (4) links to information resources that support the publication of a research paper; and (5) links to information resources that support the annual progression process.

Table 33 shows the list of links and sources within the Developing tab selected for the

purposes of this study.

Developing	
Description of Link	**Sources**
Research Development Programme (RDP) Material	
Intellectual Property Right (IPR)	http://www.ncl.ac.uk/business-directorate/commercialization/intellectual_property/whatisip.php
Career development	http://www.ncl.ac.uk/careers/develop/
The job shop	http://www.unionsociety.co.uk/pages/services/job_shop/index.html
Networking	http://www.questcareer.com/networking_skills.htm
Professionalism	http://catholicdoctors.org.uk/CMQ/2003/Feb/what_is_professionalism.htm
Research governance	http://www.ncl.ac.uk/business-directorate/policies/governance/index.php
Enterprise and innovation	http://www.enterprise.ncl.ac.uk/page.php?page_id=1
Biotechnology YES	http://www.ncl.ac.uk/fms/postgrad/seminaritem.htm?id=biotechnology-yes-a-challenge-for-you
Small Enterprise Research Unit	http://www.ncl.ac.uk/seru/seru.htm
Researcher in residence	http://extra.shu.ac.uk/rinr/site/home
Publication Materials	
The publication process	http://www.ncl.ac.uk/library/resin/writing_up/publication.php
Research peer review	http://www.parliament.uk/post/pn182.pdf
Conference alerts	http://www.conferencealerts.com/
Critical thinking	http://skepdic.com/refuge/ctlessons.html
Information technology skills	http://fms-itskills.ncl.ac.uk/
European patent office	http://www.european-patent-office.org/index.en.php
Presentation Skill Resources	
Seminar presentation	http://www.lc.unsw.edu.au/onlib/tutsem.html
Useful tips for speaking to groups	http://www.lc.unsw.edu.au/onlib/speak.html
Presentation skills	http://www.skillscentre.leeds.ac.uk/presentationtopic.php
Project Management Resources	
Project management at London School of Economic	http://www.lse.ac.uk/collections/TLCPhD/projectManagement.htm
Project management tools	http://www.projectsmart.co.uk/project-management-tools.html
Microsoft office project	http://office.microsoft.com/en-us/project/HA101656381033.aspx
Annual Progression	
General guidelines	http://www.ncl.ac.uk/student-progress/pgradmin/documents/AnnualProgressionGuidelines.pdf
Student guide for e-progression	http://www.ncl.ac.uk/student-progress/pgradmin/documents/StudentguidetoE-Progression.doc
e-Portfolio system	https://pf-postgrad.ncl.ac.uk/eportfolio

Table 33 - List of links and sources within the Developing tab

Completing Tab

The ‘Completing’ menu tab contains one research training portlet and four common portlets. The research training portlet contains information resources related to the training modules for final stage research students. The common portlets contain: (1) introduction to the content of the tab to the users; (2) links to information resources that support the research training programme in the final year; (3) links to career planning resources; and (4) link to information

resources related to research degrees' progression.

Table 34 shows the list of links and sources within the Completing tab selected for the purposes of this study.

Completing	
Description of Link	**Sources**
Final Stage Resources	
Handling large documents	http://www.students.ncl.ac.uk/alawiyah.abd-wahab/portaltest/Document/Handling_Large_Doc.pdf
Thesis format and structure	http://lorien.ncl.ac.uk/ming/dept/Tips/writing/thesis/thesis-intro.htm
Research degree examination procedure and forms	http://www.ncl.ac.uk/student-progress/pgradmin/researchdegexamandforms.HTM
Thesis production	http://www.ncl.ac.uk/library/resin/writing_up/thesis.php
Preparing for the viva	http://www.sussex.ac.uk/Users/dt31/phdviva.html
Understanding the stress	http://www.ncl.ac.uk/life-matters/help/undstress.htm
Managing the stress	http://cs3.brookes.ac.uk/student/services/health/stress.html
Handling the media	http://student.bmj.com/issues/02/07/careers/237.php
Congregation	http://www.ncl.ac.uk/congregations/
Career Planning Resources	
Career planning	http://www.ncl.ac.uk/careers/jobs/
Knowledge transfer partnerships	http://www.ncl.ac.uk/business/support/ktp.phtml
Postdoctoral works	http://www.findapostdoc.com/
Annual Progression	
General guidelines	http://www.ncl.ac.uk/student-progress/pgradmin/documents/AnnualProgressionGuidelines.pdf
Student guide for e-progression	http://www.ncl.ac.uk/student-progress/pgradmin/documents/StudentguidetoE-Progression.doc
e-Portfolio system	https://pf-postgrad.ncl.ac.uk/eportfolio

Table 34 - List of links and sources within the Completing tab

Alumni Tab

The 'Alumni' menu tab holds one RSS portlet and one HTML fragment portlet. The RSS portlet contains news update from the case University's alumni website. The fragment portlet contains information resources that support alumni. These resources include links to alumni website and information of eligibility of alumni toward library facilities.

Table 35 shows the list of links and sources within the Alumni tab selected for the purposes of this study.

Alumni	
Description of Link	**Sources**
Keeping Contact	
Alumni association	http://wwwstage.ncl.ac.uk/alumni/
Library facilities and services for alumni	http://www.ncl.ac.uk/library/services/for/alumni.php

Table 35 - List of links and sources within the Alumni tab

Summary

This appendix has provided a detailed account of the development of the web portal which was used as a data collection instrument. In section one the reader was provided with an overview of the prototype portal's structure, layout and design features, including personalisation and customisation. Section two examined the web portal in closer detail, and discussed the content of each tab within the web portal. Relevant sources for each selected links were also presented, to illustrate the applicability of the information resources to research students.

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