Improving the Website Design Process for SMEs: A Design Science Perspective

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Attestation of Authorship

"I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning."

Signature

Sangeeta Karmokar

Name

10th Sept 2013

Date

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Abstract

E-business is particularly advantageous for small and medium sized enterprises (SMEs) because it helps them increase the scale of their operations quickly and easily. Like all organisations, the success of SMEs in e-business is significantly affected by the quality of their websites. However, compared to larger firms, SME websites often do worse in retaining customer attention, providing them with the necessary information and enabling transactions. Although this is partly due to the financial constraints of SMEs, a contributing factor is the emphasis that website designers place on a website's usability. By doing so, they are paying less attention to the psychological, cognitive and other needs of the customers who use these websites. The lack of attention to these needs leads to websites that are not well or appropriately utilised, negatively impacting the e-business ambitions of SMEs.

This study adopts a design science approach (Hevner et al. 2004; March and Smith, 1995) to develop a new methodology for designing websites that takes these concerns into account. The new methodology is based on multidisciplinary principles from the field of design (Brown, 1999; Shneiderman, 1998), as they provide a framework for structuring the various concerns of users. The new methodology was tested in the design of an SME's website. Once the website was completed, the artefact was evaluated with multiple methods: in-depth interviews with users, user task analysis, and expert reviews. The in-depth interviews were used to evaluate the product (website) and the process (artefact), the user task analysis was used to evaluate the product (website) and the expert reviews were used to evaluate the process (artefact). The users scored the website highly in terms of usability and in meeting their needs, and the experts found the new process to be beneficial. This study contributes by developing a website design methodology that is anchored in its users' needs, so that the websites it produces are successful in achieving their

goals. The study concludes by offering possible avenues for extending the research topic in the future.

Publications

- **Designing an E-business Interface for SME by Embedding Users Emotional, Psychological, and Cognitive needs**

Karmokar, S. (2011, 5th August 2011). *Designing an E-business Interface for SME by Embedding Users Emotional, Psychological, and Cognitive needs*. presented at the meeting of the New Zealand Information Science Design Conference, Wellington.

- **Improving the Website Design Process for SMEs: A Design Science Perspective**

Karmokar, S., & Singh, H. (2012). *Improving the Website Design Process for SMEs: A Design Science Perspective* presented at the meeting of the International Conference on Information Resources Management, Vienna, Austria.

- **A User-Centred Framework for Website Evaluation**

Karmokar, S., Singh, H., & Tan, F. (2013). *A User-Centred Framework for Website Evaluation* presented at the meeting of the International Conference on Information Resources Management 2013, Natal, Brazil.

Chapter 1

Introduction

This study uses the design science paradigm to develop an improved methodology for designing websites for small and medium sized enterprises (SMEs). This chapter describes the study's motivation, and introduces the research question, aims and objectives of the study. The chapter also briefly discusses the methodology used to address the problem and the contribution of the study. It ends by presenting the structure of the rest of this thesis.

1.1.Research Motivation

The World Wide Web helps firms gain a competitive advantage over their rivals (Esichaikul & Chavananon, 2001; Ricca & Tonella, 2000), as they can satisfy their business needs by offering services (features) on their websites that fulfil their customers', employees' and suppliers' requirements and expectations (D'Ambra, 2001; Fraternali, 2000; Gellersen & Gaedke, 1999; Ginige & Murugesan, 2001; Leffingwell & Widrig, 2000; Martin, 2001).

From its earliest days, the World Wide Web has been seen as being particularly advantageous for small and medium sized enterprises (SMEs), because it "levels the playing field", making it possible for SMEs to reach markets denied to them through traditional channels because of

the high costs (Hoffman & Novak, 2000). E-business can also help SMEs reduce their operating, sales and purchasing costs, improve the range and quality of services they provide to customers (thereby enhancing customer satisfaction), increase market share, attract quality partners, and improve trading relationships (Hutchinson, 2008; Levy & Powell, 2005). SMEs can transform "old economy" relationships to "new economy" relationships, characterized by end-to-end relationship management solutions (integrated or extended relationships) (Hutchinson, 2008).

A key component of a strategy for obtaining these benefits is a high-quality website (Lee & Kozar, 2006; Levy & Powell, 2005). Successful websites are those that retain customers' attention, provide them with the information they require, and enable them to carry out the necessary transactions (Zeithaml, Parasuraman, & Malhotra, 2002). This level of quality is not assured by putting in place extensive features, as the central challenge is ensuring that a customer's experience with a website matches their expectations (Kirda, Kerer, Jazayeri, Gall, & Kurmanowytsch, 2001).

Despite the importance of a high-quality website for e-business, many websites are poorly designed and difficult to use (Albers & Still, 2011; Fisher, Craig, & Bentley, 2002; J. Johnson & Henderson, 2012; Schubert & Dettling, 2001; Warren, Boldyreff, & Munro, 1999). A Forrester Research review (2009) of 36 reference sites provided by 18 interactive agencies clearly illustrates this: the review gave only one site a passing

score. The highest number of severe failures resulted from poor text legibility, unclear menus, and inefficient task flows.

Poor-quality websites with design and usability issues can lead to frustrated end-users (Fisher et al., 2002) and high customer turnover (J. Johnson & Henderson, 2012), because they can easily move to competing websites if they are dissatisfied with their experience (Fisher et al., 2002). Badly designed websites can also have a negative impact on a firm's image (Barnes & Vidgen, 2001). Firms can thus gain a competitive advantage by having a quality website in a landscape where many or most e-commerce sites have design or maintenance flaws (Al-Qirim, 2004).

Prior studies have investigated the types of features that websites should have so that they can score highly across various dimensions of website quality, such as content quality, accessibility, reliability, responsiveness, ease of use, security, presence of self-service technology, credibility, visual appearance, interactivity, and user satisfaction (Lee & Kozar, 2006; Sukasame, 2005). These studies have found that features such as visual communication (Bostock & Heer, 2009), task analysis (Kules & Shneiderman, 2007), emotional usability (J. Kim & Moon, 1997) and user value (Boztepe, 2007) can help firms improve the satisfaction of their customers with their websites.

The challenge with such an approach is that website designers are provided with a laundry list of features which are "good to have", and they may find it difficult to discern which are more relevant for each particular

project. Their design process needs to integrate all of the features mentioned above such as visual communication, usability, task analysis, and the emotional needs of users. The premise of this thesis is that, in the light of this situation, focusing on the *process* by which a website is designed may provide more valuable results, rather than examining the attributes of the final *product* (the website) (Figure 1.1). This argument is built on the principle that a good design process will lead to a good product (Pries-Heje, Baskerville, & Venable, 2008). Since a website's features are specified during the design process, improving the design process may lead to a website containing features that are more appropriate for and relevant to its users.

Figure 1.1. Impact of Website Design Process

This study thus begins by evaluating current website design processes in terms of their focus on improving user satisfaction, a key aspect of a high-quality website. While few studies have examined how website development work is actually carried out, it is widely recognized that the website design industry does not have a standard process for designing websites, and website development relies heavily on the knowledge and

experience of individual or teams of developers and their practices (Al-Qirim, 2004). In addition, the ease by which a web presence is developed has encouraged many SMEs to develop their websites without following a clearly defined approach (Al-Qirim, 2004).

The design methodologies that are used in the industry (Abels, White, & Hahn, 1998; Garrett, 2002; Kvan, 2000; Nielsen, 1993; Spinuzzi, 2005) incorporate users for two reasons: 1) to understand their objectives at the initial requirements gathering stage of the design process, and 2) to obtain their feedback during the usability tests near the end of the design process. A key issue here is: Are these steps appropriate for ensuring that users' needs are satisfied? More specifically: Is the practice of involving users at the beginning and ending of the website design process adequate for capturing their goals and ensuring that the website provides value to them? Embedding users in the process of designing a product is important as it encourages them to adopt the end-product (Humphreys, Leung, & Weakley, 2008). Information systems (IS) researchers have argued that the notion of user value is largely unexplored, and that designers tend to focus on technology and the social context, satisfying in particular their relationships with those who have requested the information or whom they are trying to persuade with the information gathered and packaged through the use of technology (Lamb & Kling, 2003).

This is related to the emphasis placed by current website design processes on usability (Acharya, Kagan, Lingam, & Gray, 2008; Green & Pearson,

2011; Nielsen, 1993; Norman, 2002), which reflects an interest in ensuring a good fit between humans and "machines", the goal of traditional human-computer design research (Jacko, 2007; Maguire, 2001; Shneiderman, 1998). Usability may be an important goal for websites, but is inadequate by itself as an attribute of a high-quality website. Other factors, such as the psychological and social needs of users, should also be emphasized by website designers because they help to build trust and customer loyalty (Krieger, 2008).

An added challenge with website design is that, because website users are globally distributed and use the internet casually (i.e. they may not use the website for a fixed time period and/or at a fixed time every day), it is difficult to identify them during the development of a website, making it difficult to understand and meet their expectations (Caruana, Wilkin, & Cybulski, 2004).

The preceding discussion has argued that high-quality websites are critical for firms engaged in e-business. However, the lack of a clearly defined methodology and a narrow focus on usability mean that many websites are poorly designed and thus ineffective. Organizations will thus benefit from the creation of a well-structured design process that obtains the input of users at multiple stages, and incorporates a broader understanding of user value (beyond usability).

This issue is particularly challenging for SMEs. While ensuring that the needs of users are met is a major issue for both large and small

organizations, large companies are in a relatively privileged position as they can allocate significantly more resources, such as time, manpower and funds, to their website design projects. They can employ high-end design firms such as IDEO or Better by Design or draw on a team of in-house designers for their project. They may also have clearly defined design processes for designing websites, and be able to ensure that their users are closely involved, for example by seconding employees to the project because they have spare capacity.

SMEs, on the other hand, struggle with limited time, budgets, knowledge, and manpower (Lille, Stappers, & Lugt, 2009). Often, the design project is awarded to a freelance designer or a small design firm, who often do not have enough time and resources to thoroughly research and understand the needs of the firm's users. These small design firms may perceive that they might "lose out" on business if they spend extra time and money on user research (Lille et al., 2009). Such designers usually use an ad hoc website design process and may not be able to obtain users' detailed input because they are occupied with their daily operational tasks. As a result, it is more likely that SME websites will be of poor quality, in terms of not meeting their users' needs, which leads to challenges in obtaining the benefits of e-business.

Their resources also mean that large firms can absorb the costs of failure much more easily than SMEs. They may even decide to abandon projects at an early stage, because they have contingency plans if the website is

poorly designed. SMEs usually cannot follow the same tactics. Since they may not have a backup if the website is poorly designed, it is more important for SMEs that their websites are well designed because they have fewer opportunities to redo them. Thus, SMEs have a greater need for a well-structured website design process that considers the wider needs of their users compared to large firms.

1.2. Research Question

Based on the above discussion, this study aims to answer the following research question: *How can SMEs develop usable and useful websites through a multidisciplinary user centered approach?*

1.3. Research Methodology

This study uses the design science methodology (Hevner, March, Park, & Ram, 2004), because of its focus on building solutions for IS-related problems (Trede & Higgs, 2009). Design science involves a rigorous process for designing artefacts to solve observed problems, contribute to research, evaluate the designs, and communicate the results to appropriate audiences. This methodology, developed by Hevner and his colleagues (Hevner, March, Park, & Ram, 2004; March & Smith, 1995), provides clear guidelines for conducting and evaluating good design science research, and has been used in numerous design science studies.

In this study, the artefact that will be designed is the *process* of designing SME e-business websites, not the *websites* themselves. The underlying idea is that an effective process that incorporates the key elements that

should be considered by designers designing such websites will lead to the creation of websites that meet users' needs. This is in line with calls for the design of IS to be driven by a deep understanding of users, their needs, and their mental processes (Berg, 1998; Dray & Siegel, 2007; Lamb & Kling, 2003). The proposed design process, in general, emphasizes the use of a multidisciplinary approach based on the active involvement of users, so as to improve the understanding of users and their requirements. Thus, ideally, designers should draw from a broad variety of fields, such as sociology, anthropology, psychology and social philosophy, for their practice. Given this understanding, this study, which follows the design science approach, used the multidisciplinary principles of human-centred interaction design (Brown, 1999; Shneiderman, 1998) as its underlying theory (Walls, Widmeyer, & Sawy, 1992) to develop a new website design process.

1.4. Research Aim and Objectives

Section 1.1 highlighted that integrating the broader needs of users in website design is especially important for SMEs, because their websites are often the consequences of narrowly focused and ad hoc design processes. The aim of this study is to develop a website design process that can integrate the broader needs of users of SME websites. The study's objectives are to:

- Explore the usefulness of various design paradigms to answer the research question;

- Develop and instantiate the new design process through a case study; and
- Evaluate the ability of the design process to fulfil the study's aim.

1.5. Contributions of the Study

The primary contribution of this study is the development of a website design theory. Design theory in design science refers to a set of guidelines or principles that can be followed to design an artefact. Design theories in general guide designers in designing effective artefacts by creating and arranging images to communicate messages, opinions, feelings, thoughts or ideas (Courtright, 2002; Moore & Fitz, 1993; Paas, Renkl, & Sweller, 2003; Shneiderman, 1998). The website design theory developed here integrates both aspects: it provides a set of guidelines for developing high-quality websites by ensuring that the features of the websites, visual and otherwise, effectively reflect the needs of the users.

Venable (2006b) developed the utility theory, which has three components: the problem space, the solution space, and the nature of the utility that links them. The problem space refers to the problem/s the artefact is being designed to address, and is akin to Hevner at al.'s (2004) notion of "business needs". The solution space indicates the methods or concepts that are relevant for addressing the problem, and the utility links one or some of these concepts to a certain aspect of the problem space.

In this study, the problem space is represented by the difficulty of

developing high-quality websites, while the solution space comprises the variety of design theories, such as classical design theory, cognitive design theory, and semiotics design theory. Traditionally, design science research in IS has not drawn from the field of design, preferring to use behavioural or economic theories as the basis for building artefacts (Gregor & Jones, 2007). This divide between design science and design could be due to the origins of design science being in engineering and other applied sciences, such as systems development and software development. The website design theory developed here combines both types of theory, and will hopefully encourage future design science researchers to also draw on other theories from the field of design. The principles of multidisciplinary design (Baddeley, 1997; Brown, 1999; Dray & Seigel, 2007; Egger, 2001; Endsly, Bolte, & Jones, 2000) are especially useful for broadening the prism through which design science researchers develop new artefacts.

For practitioners, the study will identify the various needs of users in the website design process, and offer an easy-to-follow methodology to ensure their websites are usable and meet the latent needs of users. The multi-step evaluation process will also help ensure the effectiveness of their websites. SMEs will find the new design process especially useful in competing against larger rivals, as it takes into account their limited resources. Over time, their use of the new process will help them achieve their e-business goals.

1.6. Structure of the Thesis

This thesis is organized in the following manner:

Chapter 2 (Literature Review) is a critical summary of research on website design and multidisciplinary design, and identifies the gap in the literature that is the focus of this study. The literature review also discusses the literature on design science.

Chapter 3 (Research Methodology) presents the rationale for the approach, and describes how the artefact will be designed and evaluated.

Chapter 4 (The Design of the Artefact) describes the various processes involved in designing websites, and presents an instantiation of the artefact in the form of a case study, in which a SME's website is designed using the new methodology.

Chapter 5 (Evaluation of the Artefact) focuses on the methods used to evaluate the artefact. The three methods used to do so are presented in detail, along with the results of the evaluation processes.

Chapter 6 (Discussion & Conclusion) summarizes the main findings of the research, and presents some limitations of the study and opportunities for future work.

Chapter 2

Literature Review

Introduction

This study's aim is to use the principles of design science to articulate a website design process that will produce websites which are a better fit for the needs of their users. To do so, we need to clarify the role of users in the design of information technology (IT) artefacts and their needs. This chapter will review the literature in the following related areas: interface design, website design, usability, and multidisciplinary design. It also identifies a gap in the existing literature on website design methodologies and discusses the benefits of embedding users' needs in the interface design process. Finally, this chapter demonstrates why design science is an appropriate methodology for this study.

2.1. Interface Design

Interface design is used in the development of a wide range of products, from computer systems to cars and commercial planes, all of which involve similar aspects of human interaction. The main purpose or goal of any interface design is to make the users' interaction with the artefact as simple and as efficient as possible (Wallace & Anderson, 1993).

There are many ways to define the term "interface" and researchers and

designers use it differently according to their interests. While some focus on the software interface (Hackos & Redish, 1998) and others on user interfaces (Nielsen, 1993), Wallace and Anderson (1993) define "interface" in a much broader way to cover a wide range of disciplines. They offer four approaches to interface design (Figure 2.1). The first is the *craft approach* where each design project is viewed as unique; solutions evolve, under the guidance of a skilled human factors expert, to suit the circumstances. The second approach is *enhanced software engineering*; in this case, attempts are made to introduce human-centred interaction design techniques into the repertoire of traditional systems engineering. The third approach is called *cognitive engineering.* This is the most theoretical approach to interface design, and applies cognitive psychology to the problems facing designers to come up with an optimal design. Finally, the *technologist* approach, which has had more impact in recent years, uses software to automate interface design.

Table 2.1: Approaches to Interface Design

	Craft Approach	**Enhanced Software Engineering**	**Cognitive Engineering**	**Technologist Approach**
Philosophy	Craft oriented design through skill and experience	Incorporate HCI into software engineering	Apply psychological knowledge base to achieve optimal design	Quantify and automate the design process
Focus	Specification Design implementation	Specification	Specification Evaluation	Implementation

Role of Practitioner	Craftsman/artist Multidisciplinary collaboration	Traditional analyst Broadening the scope of software engineering	Psychologist Ergonomist Human factor specialist	Software tools developer

(Source: Wallace & Anderson, 1993)

In this study, both the craft and cognitive engineering approaches to interface design are adopted. The craft approach involves designing interfaces based on skill and experience, and emphasizes the need to consider the multidisciplinary aspects of design. It allows designers to be innovative and allows their creativity to flourish. The cognitive engineering approach, on the other hand, encourages designers to understand users' psychologies, ergonomics, and human factors during the interface design process (Wallace & Anderson, 1993). Users hold a prominent place in the overall design process.

In this study, the term "interface" refers to the website interface. In the following sections, the methodologies that are currently used for designing websites are discussed.

2.2. Website Design

The importance of websites in organizations has become increasingly evident in the last 15 years. The rapid and successful deployment of websites is often critical for the business strategy of many organizations, particularly with respect to the way in which they interact with customers, clients, and/or business partners. Thus, website design is a key

aspect of operationalizing business activities. This section discusses the various fields that website designers have drawn on to develop website design methods. It begins with human–computer interaction (HCI) and software design, before discussing current website design methods and their shortcomings.

2.2.1. Human–Computer Interaction (HCI)

HCI is the study of the issues that arise when people encounter computer-based technology, and the way understanding of these can aid in improving the design of technology (Hooper & Dix, 2012). It is concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of the major phenomena surrounding them (Hinze-Hoare, 2007).

The origin of HCI can be traced back more than 50 years. HCI lies at the intersection between the social and behavioural sciences on the one hand, and computers and information on the other. HCI professionals analyse and design user interfaces and user interface technologies. In the past they have helped to develop and investigate the concepts of the graphical user interface paradigm of windows, menus, icons and mouse pointing. HCI researchers and designers have created software tools and developed environment to facilitate the construction of graphical user interfaces. Today, this work continues in developing devices for mobile computing, information visualization for digital libraries, and navigation techniques for virtual environments (Carroll, 2009).

The success of HCI through the past two decades was due to its multidisciplinary principles. HCI draws its principles from various domains such as anthropology, communication studies, human factors engineering, social psychology, ergonomics, sociology and many areas of computer science (Brown, 1999; Carroll, 2009; Shneiderman, 1998). The discipline of HCI really began to interact with the website design discipline with the growth of internet use in the 1990s. Website design and HCI are interdisciplinary arenas concerned with the intersection of people and technology. HCI and website designers share similar application areas and often ask similar questions. However, HCI researchers build and evaluate tools and study the broader societal implications and interactions resulting from their systems, while website designers use the tools HCI researchers develop (Shneiderman, 2007). For example, HCI's user experience tools could help in understanding people's experiences of the web and mobile web. There are strong areas of overlap between HCI and website design, particularly when it comes to usability, cultural awareness, the evaluation of web-based systems, interfaces for web / mobile / ubiquitous computing, aesthetics, motivation, social participation, trust, empathy, responsibility, and privacy (Shneiderman, 2007). HCI methods and user centered design (UCD) improve the design and evaluation of complex user interfaces and aid corporate web-mapping application development (Newman et al., 2010).

HCI researchers have worked in website design areas to develop methodologies for designing effective interfaces based on HCI principles. In the past, HCI mainly focused on efficiency, effectiveness, satisfaction and product usability (Issa & Turk, 2012). Currently, HCI researchers are seeking to understand and support human beings and their interaction with systems in respect to knowing, doing and feeling (Issa & Turk, 2012). A "growing community of innovative tool designers and user interface visionaries is addressing a greater challenge and moving from the comparatively safe territory of productivity support tools to the more risky frontier of creativity support tools" (Shneiderman, 2007, p. 22)

HCI research is focusing on developing creativity support tools in areas such as sciences, exploration in design, innovation in engineering, and imagination in the arts (Shneiderman, 2007). For example, well-designed software tools can help creators in generating multiple possibilities, showing the implications of their choices and tracking their design decisions.

- By applying usability and HCI principles in developing marketing websites Issa and Turk (2012) build tools that enable users to save their history, edit it, email it, and replay it thousands of times with different parameters.
- Newman et al. (2010) developed interactive web-mapping applications for designing, implementing, generating and delivering maps on the internet

- Zhao, Plaisant, Shneiderman, and Lazar (2008) developed data sonification for users with visual impairment that enables users to map data to multiple auditory parameters and add context using a graphical interface.
- Using patterns as an interaction, Seffah (2010) designed tool data entry systems.
- Lim, Lee, and Lee (2009) proposed a new way of thinking about and describing interactive attributes.
- A new healthcare system and services was designated by Jones et al. (2011) using patient-centred and human-centred design principles.

2.2.2. Software Design

A software project, regardless of whether it is large or small, goes through certain defined stages, which together are known as the software development life cycle (SDLC).

The SDLC has five phases:

- Planning Phase – Identify problems or opportunities
- Analysis Phase – How can we solve the problem?
- Design Phase – Select and plan the best solution
- Implementation Phase– Place solution into effect
- Testing Phase – Evaluate the results of the solution

Commonly used SDLC models include waterfall, incremental, spiral, agile, and rapid application development (RAD). In the SDLC, activities such as planning, analysis, design, coding and testing need to be performed according to the needs of the customer (Seema & Malhotra, 2012). The

waterfall method is very simple to understand and use. The next phase in this model must begin only after the previous phase is over. It has underpinned all other models as it provides a firm foundation for requirements to be defined and analysed prior to any design or development (Ruparelia, 2010).

The incremental model is an evolution of the waterfall model. The product is designed, implemented, integrated and tested as a series of incremental builds. The phases of waterfall model are employed in such a manner that the result of each increment is used as the input for the next. Thus, with each increment, client feedback is used in getting the next incremental product (Massey & Satao, 2012; Ruparelia, 2010).

The spiral model combines the idea of iterative development (prototyping) with the systematic, controlled aspects of the waterfall model. It allows for incremental releases of the product, or incremental refinements to emerge each time around the spiral. The spiral lifecycle model allows for elements of the product to be added in when they become available or known. This assures that there is no conflict with previous requirements and design (Massey & Satao, 2012; Ruparelia, 2010).

The agile model is iterative and incremental-based, where requirements are changeable according to customer needs (Sharma, Sarkar, & Gupta, 2012). This helps in adaptive planning, iterative development, and time boxing. The agile process follows a life cycle that includes requirements gathering, analysis, design, coding, testing, delivering partially

implemented software, and waiting for customer feedback. In the whole process, customer satisfaction is the top priority, along with fast development time (Sharma et al., 2012). The agile model requires active customer involvement throughout the process (Sharma et al., 2012). The deliverables developed after each iteration are given to the user for use and improvements are based on customer feedback only. The final product is of high quality and customer satisfaction is ensured as the entire project has been based on the customer's requirements.

The agile model has been used in designing user interfaces. Due to its iterative process, flexibility and user involvement, agile software development methods are being adopted at an increasing rate. UCD and the agile model have distinct approaches and attempts have been made to integrate the agile process with UCD principles (Salah, 2011), usability and interaction design (Losada, Urretavizcaya, & Castro, 2011). Several studies have examined various aspects of the integration of agile methods and usability/UCD (Hussain, Slany, & Holzinger, 2009). For example,

- Patton (2008) provides details on the integration of interaction design into an agile process, describing 12 best practices for adding user experience work to agile development.
- Humayoun, Dubinsky, and Catarci (2011) developed a threefold framework to incorporate UCD into agile software development.
- Adikari, McDonald, and Campbell (2009) used a design science approach to integrate usability into agile requirements engineering.

- Humayoun (2012) integrated usability and agile methods in evaluating usability in software development environments.
- Sy (2007) describes her company's process of integrating agile methods with UCD.

The RAD model enables organizations to develop strategically important systems faster while reducing development costs and maintaining quality (Ruparelia, 2010). RAD combines the best available techniques and specifies the sequence of tasks that will make those techniques most effective. This model makes use of evolutionary prototypes that are eventually transformed into the final product. A set of computer-aided software engineering (CASE) tools is used to support modelling, prototyping and code reusability, as well as automating many of the combinations of techniques (Seema & Malhotra, 2012). It is a process through which the development cycle of an application is expedited. RAD replaces hand-design and coding processes, which are dependent upon the skills of isolated individuals, with automated design and coding, which is an inherently more stable process. RAD may thus give an IS organization its first real basis for continuous improvement (Ruparelia, 2010).

Active user involvement throughout the RAD life cycle ensures that business requirements and user expectations are clearly understood. RAD takes advantage of powerful application development tools to develop high-quality applications rapidly. Prototyping is used to help users visualize and request changes to the system as it is being built, allowing applications to evolve iteratively. RAD promotes a collaborative

atmosphere where business stakeholders participate actively in prototyping, creating test cases and performing unit tests. Decision making is devolved away from a centralized structure to the functional team (Massey & Satao, 2012; Ruparelia, 2010).

Various models of SDLC have been used in designing websites and building security for web applications. For examples,

- Faridi, Mustafa, and Jan (2012) integrated human persuasion in SDLC.
- French (2011) developed a new methodology for developing web applications.
- Hu (2010) designed a web service-based prototype for improving patient access to primary health care.
- Durrani and Qureshi (2012) proposed tools to integrate usability engineering practices in the SDLC.
- Using the waterfall model, Othman, Ismail, and Raus (2009) developed a web-based attendance register system of a higher education institute.

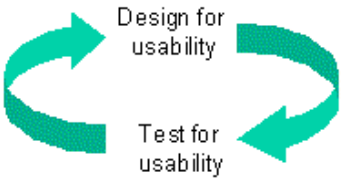
2.2.3. Website Design

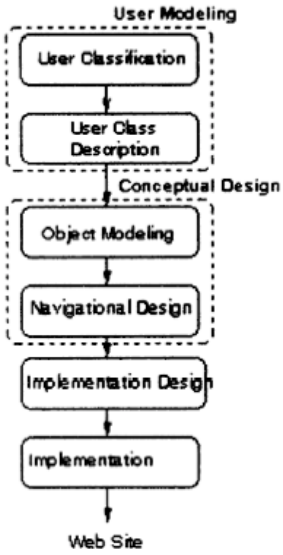
Website design projects usually have a shorter timeframe and often include direct interaction between various stakeholders (Lowe & Eklund, 2002). Websites are often developed very quickly from templates using coarse-grained web-authoring tools. There is no one particular design process that web designers use, and various processes have been

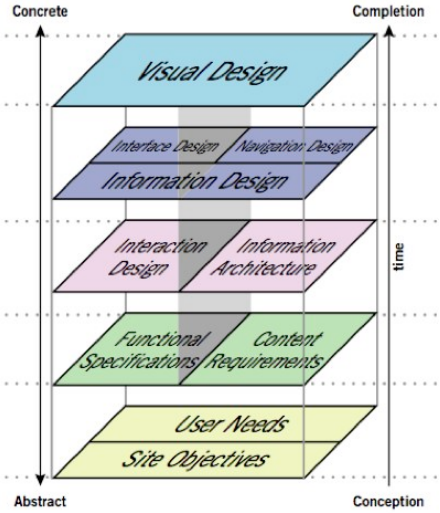
developed in recent years (Table 2.2).

Table 2.2: Examples of Existing Website Design Processes

Method	Details
Usability Approach (Nielsen 1993)	**Involve users from the beginning by:** • Discovering their mental models and expectations • Including them as an integral part of the design/development process and team • Observing them at their workplace, validating your assumptions about them, analysing their tasks, workflow, and goals • Eliciting feedback via walkthroughs, card sorting, paper prototypes, think-aloud sessions, and other methods **Know your users:** How much experience do the users have with: • Computers? The Web? Domain (subject matter)? • What are the users' working/web-surfing environments? • What hardware, software, and browsers do the users have? • What are the users' preferred learning styles? • What language(s) do the users speak? How fluent are they? • What cultural issues might there be? • How much training (if any) will the users receive? • What relevant knowledge/skills do the users already possess? • What do the users need and expect from this website? **Analyse users' tasks and goals**: Observe and interact with users (preferably at their workspace) as you attempt to answer questions such as: • What tasks do users need to perform; how do they currently perform these tasks? What is the workflow? • Why do the users currently perform their tasks the way they do? • What are the users' information needs? • How do users discover and correct errors? • What are the users' ultimate goals? **Don't settle on a final direction too soon:** Explore different designs and approaches and get user feedback before making final direction, development, and design decisions. **Test for usability- repeatedly:** Usability testing is an iterative process; it is important to conduct usability testing throughout the

	development cycle.  **Figure 2.1: The Process for Testing Usability** **(Source: Nielsen, 1993)**
User-Based Design Process **(Abels et al., 1998)**	**1. Information gathering stage** • Identify user criteria • Rank the criteria **2. Development Stage** • Define and/or operationalize the criteria. • Assess the implications of the ranked criteria for design. • Establish priorities of criteria based on feasibility. • Translate the criteria into Web page features. • Incorporate feedback mechanisms into design. • Design a preliminary version of the Web page. **3. Evaluation stage** • Evaluate the Web page and/or features of the page from the users' perspective. • Modify the page based on feedback. • Repeat process until acceptable version is ready. **4.Implementation Stage** • Activate continual feedback mechanisms to allow users to evaluate the page and suggest content or other modifications. How do users discover and correct errors? • Announce the site's availability • Monitor and modify as necessary
Web Semantics Design Method (WSDM) – User-Centred Design	**User Classification:** The audience of the Web site is identified and classified by looking at the organization or the process for which the website will be built. **User Class Description:** User classes are analysed in more details regarding their focus, requirements, characteristics and motivation. **Object Modelling:** The information requirements expressed in the user class descriptions are formally modelled.

Method **(Troyer & Leune, 1998)**	**Navigation Designing:** A conceptual navigation model is constructed. **Implementation Design:** The "look and feel" of the Web site is designed. The aim is to create a consistent, pleasing and efficient look and feel for the users. **Implementation:** The last phase is the actual realization of the website in the chosen implementation environment.  **Figure 2.2: Overview of User-Centred Design Principles of WSDM (Source: Troyer & Leune, 1998)**
Iterative Design Model **(Lowe & Eklund, 2002)**	**1. Specify** • Explore the needs of users • Develop clients understanding **2. Build** • Build the website according to the specification • Monitor and modify as necessary **3. Evaluate** • Successive designing • Refining the design • Modification of specification • Repeat process until desired results achieved.

Participatory Design Methodology **(Garrett, 2002)**	**User Needs:** Assessing users' needs includes understanding: the site's objectives, what the site must do for the person who uses the website, users' expectations, and use of the product. **Functional Specification:** This phase of design includes questions such as: what application features will users need to fulfil their goals? **Interaction Design:** How will users move from one place to another? What actions can systems take in response to users? **Interface Design:** Interface design facilitates user input and system output. It communicates the choices available to the users. **Visual Design:** This phase includes the look and feel of the website.  **Figure 2.3: Overview of User-Centred Design Principles** **(Source: Garrett, 2002)**
Participatory Design Methodology **(Spinuzzi, 2005)**	**1. Initial exploration of work** • Meet with users and familiarize with the environment • Explore the technologies used **2. Discovery processes** • Designers and users interact to understand and prioritize work organization • Clarify users' goals and values on desired outcome. **3. Prototyping** • Designers and users iteratively shape technological artefacts to fit into workplace environment.

The design processes in Table 2.2 are very varied. Lowe and Eklund's (2002) process is a collaboration between the client and the designer to understand the client's requirements, while Abels and White's (1998) process is based on the usability requirements of users. Questionnaires and interviews were used to collect data from users. The questions on the usability of a design focus on its appearance, searchability, links, and structure.

Spinuzzi's (2005) participatory design process emphasizes co-design. Users are actively involved in the design process, from the initial exploration of work to final prototyping. The participatory design process is also used in software and systems design. In participatory design, users' knowledge is highly valued and the focus is on exploring the knowledge and taking it into account during the design process. While the UCD process and participatory design process involve users in the design process, the iterative design process is mostly client-focused (the client is the organization or a person who has commissioned the project and the user is the person who uses the final artefact).

Usability, an important aspect of website success (L. Kim, Young, & Neimeyer, 2008; Mennecke & Strader, 2002a), is defined as the ease of use and acceptability of a system. Some methods for ensuring the usability of websites are summarized in Table 2.2 (Garrett, 2002; Nielsen, 1993; Troyer & Leune, 1998). These studies examine how the usability needs of users can be integrated into the design process through methods such as

early involvement of users, assessments of their usability requirements, and the use of usability tasks to evaluate the design.

Table 2.2 indicates that the involvement of users is crucial for effective interface design. Garrett (2002) and Troyer and Leune (1998) define users' needs and objectives at the initial stages of the design process, although little or no consideration is made for usability tests and user input during the design phase. In contrast, Nielsen (1993) emphasizes the consideration of user needs in every phase of the design process, up to the final launch phase. The final product is tested repeatedly for usability before it is implemented in the market.

2.3. Shortcomings of Current Methods for Website Design, HCI Design, and Software Design,

2.3.1. Website Design

Table 2.3 indicates that the prime focus of most website design methodologies is on clarifying the functional requirements of users and on the usability of websites, with regard to their appearance, navigation, functionality and interaction. This is in keeping with traditional design practice, which begins with identifying the system's requirements, or the functional demands the system should meet. This process primarily consists of asking those who ordered the artefact what exactly they want the artefact to do.

Table 2.3: Comparison of Website Design Methodologies

Method	Focus of Design Process	Where is the Gap?
Usability Approach (Nielsen, 1993)	• Users' usability needs • Website Effectiveness • Repeated usability evaluation	Other needs of the users such as psychological, emotional and cognitive.
WSDM – User-Centred Design Method (Troyer & Leune, 1998)	• Identification of website audience • Identification of users' requirements, focus and motivation • Efficient look and feel for the users	Other needs of the users such as psychological, emotional and cognitive.
Participatory Design Methodology (Garrett, 2002)	• Understanding users' expectations and use of the website • Emphasis on functional, interaction and visual design	Other needs of the users such as psychological, emotional and cognitive.
User-Based Design Process (Abels et al., 1998)	• Initial requirements of the users	Other needs of the users such as psychological, emotional and cognitive.
Iterative Design Model (Lowe & Eklund, 2002)	• Focus on clients' needs	• Requirements of users • Other needs of the users such as psychological, emotional and cognitive.
Participatory Design Process (Spinuzzi, 2005)	• Exploration of users' usability needs	Other needs of the users such as psychological, emotional and cognitive.

The challenge with this emphasis on system features is that, in the real world, the individuals who ordered the artefact to be built (the clients) are sometimes not the same people who will use it (the users), and those who compile the requirements are not the ones who will design the system (Holzinger, 2005; Lamb & Kling, 2003). There is thus a large gap between

those who design the technology and those who actually use it (Berg, 1998). Designers complain that they do not know what the users want and users complain about the system and technology not fitting the workplace (Greenbaum & Kyng, 1991). There may thus be a mismatch in terms of the features in the new system and users' expectations.

One remedy for this is to involve users at the initial stages of the design process. When users are involved in the design process, they can design the outcome they desire, helping to increase its acceptance. Embedding users in the design process encourages other users to provide input and adopt the end-product (Humphreys et al., 2008). Users generate a wealth of ideas that capture the shared knowledge of the user community and reflect the community's needs more effectively (Krieger, 2008).

The participatory method in Table 2.3, proposed by Spinuzzi (2005), involves users in the design process to some extent, as it identifies their goals and values. However, it has some limitations. Since participatory design aims to ground changes in traditional craft skills as a way of empowering workers, some argue that participatory design does not lend itself to radical change of the sort that sometimes must characterize a new system (Beyer & Holtzblatt, 1998). Participatory design can lead to tunnel vision where a particular stakeholder is served and others are left to fend for themselves (Sumner & Stolze, 1997). The iterative design model (Lowe & Eklund, 2002), meanwhile, fails to identify the needs of users and integrate them in the final design. These processes are oriented more

towards the client organization, not the users.

Nielsen, Garrett, and Troyer advocate the importance of involving users (see Table 2.2), and obtain the input of users at the requirements gathering stage and when evaluating the usability of a website. Usability measures how easy user interfaces are to use, and has five dimensions or quality attributes: learnability, efficiency, memorability, errors, and satisfaction (Nielsen, 2003). It is worth noting that the usability test and heuristic checklist developed by Nielsen (1993) and others are useful but potentially inaccurate. Instead of studying the actual user interface, they collect the opinions of users about the interface. This is problematic because user statements cannot always be taken at face value (Mennecke & Strader, 2002b). While there are other methods for testing usability, such as action analysis and indirect methods, few designers are aware of these alternative methods, and most are unable to quickly determine which method is best suited for a particular design situation. Moreover, such methods are time-consuming and require a high level of expertise on the designer's part (Holzinger, 2005).

More importantly, the design process is not set up to enable evaluation to be carried out effectively, because usability testing or inspection is carried out at the end of the design process when it can be costly and difficult to implement changes to the interface (Holzinger, 2005). There is potential tediousness and the danger of an inherent bias due to the selection of an

inappropriate tool for the task, an emphasis on low-level details, and the lack of involvement of users. As Holzinger (2005) points out, designers and developers usually feel that the products they have designed do not have any usability problems, and often ignore such issues at the end of the design cycle. The results of usability tests depend upon the test or checklist selected for testing the usability of the artefact. The earlier critical design flaws are detected, the more likely they can be corrected. Thus, user interface design should integrate users at the initial stages of the design process.

Usability tests also restrict designers from obtaining deep insights into user behaviour (Mennecke & Strader, 2002b). They create a gap between designers and users, leading to an inability to identify or allow for users' unknown needs and unreliable problem identification (Holzinger, 2005). Users do not necessarily evaluate the complete design, since there is no mechanism to ensure that entire design is explored and evaluators can focus too heavily on one section (Holzinger, 2005).

2.3.2. Software Design

The SDLC is used as a benchmark for application development due to it being a complete methodology containing all of the steps required for development of applications. Due to the nature of the web application development environment, time schedules for development are relatively short, often being less than one or two months. Websites and web applications require a high degree of granularity that is often not

completely suited to the SDLC (French, 2011). The basic concept behind the SDLC is that there is a well-defined process by which an application is conceived, developed and implemented. The speed at which websites need to be developed and additional factors such as navigation, design and the graphical component add complexity that is beyond the limits of the SDLC (French, 2011).

Developing web applications is a highly complex problem consisting of many dimensions from various disciplines that must be addressed for web development to be successful. Among the different SDLC models, agile software development is being adopted at an increasing rate in the industry because of its iterative nature and the use of multidisciplinary teams to some extent. Dyba and Dingsoyr (2009) reviewed empirical studies of agile software development and found that agile methods are still lacking usability awareness in their development lifecycle, and that the integration of usability/user centered design into agile methods is not adequately addressed. Holzinger (2005) points out the need for awareness of the various usability methods and their respective applications on the part of software practitioners. Memmel, Reiterer, and Holzinger (2007). comment that "When usability engineering becomes part of agile software engineering, this helps to reduce the risk of running into wrong design decisions by asking real end users about their needs and activities", (p72). Efforts at integrating usability and UCD into software engineering have been made for many years. However, since agile methods are a relatively

recent and emerging idea, there has not been much work done on the integration of usability and UCD into agile methods (Hussain et al., 2009).

Agile methods have evolved to address some of the limitations of planned and structure-driven approaches. They are iterative in nature but none of the existing agile processes explicitly include principles and practices for understanding and verifying usability and user experience requirements. Similarly, design practices for satisfying requirements for usability and user experience or practices for evaluating agile systems for usability and user experience are generally absent. In general, it is not clear yet how to incorporate UCD into agile processes without sacrificing the acknowledged benefits of the latter (Salah, 2011).

The focus of integrating agile methods and UCD should be on design as well as on usability evaluation. Evaluation often happens using low-fidelity prototypes with the goal of improving the design. Although there are a reasonable number of papers on the integration of UCD and agile development, not many are focused on integrating UCD principles in the design process; however the usability aspect in design and evaluation has been addressed well (Silva, Martin, Maurer, & Silveira, 2011).

It should be noted that keywords relating to agile methods and UCD are not standardized and my choice of keywords and string searches may have missed some relevant studies (Silva et al., 2011). The agile methodology helps management take decisions about the software being developed, set goals for developers, and fix deadlines for them. But it is very difficult for

developers to cope with the ever-changing needs of the users and constantly change designs based on just-in-time requirements (Sharma et al., 2012).

2.3.3. Human–Computer Interaction (HCI)

HCI plays a improtant role in investigating human reactions and opinions towards computers and created the technological possibilities that brought about a paradigm shift away from the desktop and opened up a wide range of new and interesting uses of computer technology (Kjeldskov & Paay, 2012). Obtaining an immediate response from website users is important, especially when they are under time pressure and experiencing task complexity. While there is growing body of HCI website research, issues concerning immediate response from users have received limited attention (Valacich, 2012). Website design needs to incorporate a wide variety of user needs such as emotional, social, cognitive and visual. In the early 2000s the multidisciplinarity of design in HCI was not yet strong (Lopatovska & Arapakis, 2010). Because engineering is still predominantly informed by applied research, knowing what systems to build and what problems to solve still dominates within the more technical camps of HCI (Kjeldskov & Paay, 2012). Understanding human emotions and needs towards computers is still quite a neglected issue in HCI design methods (Dybala, Ptaszynski, Rzepka, & Araki, 2010). It is also unclear exactly how to make use of "new" methods like field studies, case studies, and action research in HCI design methodology, to find out what value they could possibly bring to a specific project (Kjeldskov & Paay, 2012). In

terms of design methodology the methods and techniques from social science, the humanities, psychology, and the arts do not yet have a strong presence in the minds and traditions of the dominant HCI researchers. There is lack of studies in exploring rich real-world use cases, contexts and user needs to gain deeper understanding of user needs (Kjeldskov & Paay, 2012).

Although principles of reasoning has become increasingly driven by rigorous techniques and principles, the design and engineering of the user interface has remained ad hoc and thus has resulted—from a software engineering point of view—in applications of poor architectural quality, causing tremendous costs for maintenance and further evolution (Gaedke, Segor, & Gellersen, 2000). The lack of standards and the broad diversity of design methods have led to the fact that no efficient concept for reuse of solutions and designs has been established. To support systematic user interface design and development, a process incorporating a disciplined form of reuse is needed (Seffah & Taleb, 2012).

Historically, best practices reusability in HCI has attracted far less attention in comparison with other disciplines like software engineering, but this trend has been changing (Seffah & Taleb, 2012). In current practice, tools for capturing and disseminating design knowledge include guidelines, claims and patterns. Guidelines concentrate most often on the physical design attributes of the user interface, and examples are the Macintosh Human Interface Guidelines and the JavaLook and Feel

Design Guidelines (Microsystems, 2001). Guidelines are a means to capture HCI knowledge in association with a specific artefact and usage context. They provide design advice based on theoretical foundations, cognitive design rationale, and possible trade-offs (Seffah & Taleb, 2012). Although both guidelines and claims promote reuse, they have yet to be adopted by the mainstream designer with multidisciplinary principles of design. Studies have shown that interface guidelines suffer from being too abstract to directly apply, while claims are too grounded in specific scenarios and examples, limiting their generality (Seffah & Taleb, 2012).

Yet, the disciplines that study HCI have only recently started to investigate this phenomenon and gain understanding of its causes and effects. Some progress has been made in developing "affective systems" that are capable of recognizing and appropriately responding to human emotions and behaviours but these have not been adopted by mainstream designers (Lopatovska & Arapakis, 2010).

2.3.4. Conclusion

The preceding paragraphs have shown that users play a limited role in current website design processes. However, even in the domain in which they are most heavily engaged (usability evaluation), it is possible that the structure of the process may not lead to useful, reliable or accurate results. This situation reflects Lamb and Kling's (2003) argument that the user concept is too narrowly defined in the research and practice of IS design, development, and evaluation. Despite the popularity of the user

experience, understanding user satisfaction and preferences remains a challenge.

The methods and models that assist in comprehending the dynamic changes of users needs tend to ignore the importance of users' holisitic experiences in relation to usability and HCI. By relying on individualistic models that emphasize task models, ergonomic factors, and cognitive psychodynamics, research in this domain has adopted a limited view of users. This has been compounded by the use of laboratory experiments or surveys by most research studies in this domain to evaluate the task/technology fit of computer systems at the individual use level, ignoring the needs of actual users (Lamb & Kling, 2003).

This call to understand users in their natural states has been paralleled by the rise in the prominence of UCD. The field of design has shifted its focus from giving form to objects and information to enabling user experiences, and from physical and cognitive human factors, to the emotional, social, and cultural contexts in which products operate and communications take place (Boztepe, 2007). Maguire (2001) identified the key principles of human-centred design as being: a) the active involvement of users and a clear understanding of user and task requirements; b) the engagement of users with the design from the early stages of the design process; and c) the need for design to be a multidisciplinary design team effort. Attempts have been made in HCI and SDLC methodologies but they fail to consider the broader aspect of users needs. Some progress has

been made in integrating the principles of other disciplines and appropriately responding to human emotions and behaviours, but true multidisciplinarity is still lacking in the website design process.

The challenge is thus to develop a new website design process that adequately captures the multiple aspects of users' needs, going beyond usability and functional requirements. However before we review the literature on human-centred design, we discuss the design science approach that will be used for answering this study's research question. This is because it is important to understand the framework under which the study is being carried out. In addition, we will also contrast it with traditional approaches to design thinking and discuss how the two domains can be integrated.

2.4. Design Science Research

This study focuses on developing a website design process that incorporates broader aspects of users' needs. Design science was identified as a suitable approach for this study because it provides a rigorous process for designing and evaluating artefacts that solve observed problems, and for communicating the results to various audiences, as well as contributing to research.

Information systems (IS) are implemented within an organization to improve its effectiveness and efficiency (Weber, 1997). The utility of the IS and characteristics of the organization, its work systems, its people, and its development and implementation methodologies together determine

the extent to which that purpose is achieved (Hevner & Chatterjee, 2010).

There are two distinct paradigms of research in the IS discipline: behavioural science and design science (March & Smith, 1995). The behavioural science paradigm has its roots in natural science research methods. It seeks to develop and justify theories that explain or predict organizational and human phenomena surrounding the analysis, design, implementation and use of IS. Such theories ultimately inform researchers and practitioners of the interactions among people, technology and organizations that must be managed if an IS is to achieve its stated purpose.

On the other hand, design science is a paradigm that has its root in engineering and the sciences of the artificial (Simon, 1996). Design science is fundamentally a problem-seeking paradigm; it aims to create an innovation that defines the ideas, practice, technical capabilities and product, through which the analysis, design, implementation and use of an IS can be effectively and efficiently accomplished. Design science is important for a discipline oriented towards the creation of successful artefacts.

For some researchers, it is not enough to study and understand why nature is as it is; they want to know how they can improve the way it is (Cross, 2001). Design science research attempts to focus human creativity into the design and construction of artefacts that have utility in application environments (Hevner & Chatterjee, 2010). Design activities

are central to most disciplines. Research in design has a long history in many fields including architecture, engineering, education, psychology, and the fine arts (Cross, 2001). The design science research paradigm is highly relevant for IS research because it directly addresses two of the key issues of the discipline (Weber, 1997): the central, albeit controversial, role of the IT artefact in IS research and the perceived lack of professional relevance of IS research.

The use of design science research in the IS field has been increasing slowly. Research in IS has been dominated by studies of the impact of IT artefacts on organizations, teams and individuals. Design science has been traditionally considered the province of more technical areas like computer science or engineering. However in the 1990s, the IS community recognized the importance of design science research for improving the effectiveness and utility of IT artefacts in the context of problem solving in the real-world business process. Evidence of this awakening came with the 1991 formation of the Workshop on Information Technology and Systems (WITS), ground-breaking research by Nunamaker et al. (1991) and the Group Decision Support Systems (GDSS) team at the University of Arizona, and new thinking on how design science is defined, theorized and actualized in the IS field (e.g. Hevner & Chatterjee, 2010; March & Smith, 1995).

Some engineering literature, for example Eekels and Roozenburg (1991), has pointed to a need for a common design science research methodology.

Archer's (1984) methodology focuses on one kind of design science research and sees building system instantiations as the research outcome, or "the purposeful seeking of a solution" to a problem formulated from those desires (McPhee, 1996). Archer (1984) believed that design could be codified, even the creative part of it and defined design science research in six steps: programming (to establish project objectives), data collection and analysis phases, synthesis of the objectives and analysis results, development (to produce better design proposals), prototyping, and documentation (to communicate the results).

IS researchers have addressed the issue of what goals to pursue when conducting design science research (e.g. Hevner et al., 2004) and provided theoretical frameworks to justify design research studies (e.g. Nunamaker et al., 1991; Walls et al., 1992). However, historically there was little focus on the development of a consensus process and mental model. This might help to explain Walls et al.'s (1992) findings about how their 1992 article had impacted the IS community: while 26 papers had cited their paper, their overall feeling was that the message had not gotten through. Table 2.4 lists some of the dominant design science methodologies.

Table 2.4: Design Science Research Methodologies from IS and Other Disciplines

	(Hevner et al., 2004)	March and Smith (1995)	Nunamaker et al. (1991)	Archer (1984)	(Walls, Widmeyer, & Sawy, 1992)

Research Activities	Important and relevant problems		Construct a conceptual framework	Programming Data collection	Meta-requirements Kernel theories
	Implicit in "relevance"				
	Iterative search process Artefact	Build	Develop a system architecture Analyse and design the system. Build the system	Analysis Synthesis Development	Design method Meta design
	Evaluate	Evaluation	Experiment, observe, and evaluate the system		Testable design process/ Product hypotheses
	Communication	Theorize and Justify		Communication	

(Source: Peffers et al., 2008)

Table 2.5 provides examples of the topics that have been studied by some recent design science studies.

Table 2.5: Examples of Design Science Studies

No.	Author/s	Theories Used	Artefact Developed
1.	Bragge, Tuunanen, Virtanen, & Svahn (2011)	Design Science-Hevner	**Repeatable Collaborative Process –** for setting up emerging value systems for new technology fields.
2.	Levermore, Babin, & Hsu (2010)	Design Science – Hevner	**A Database Design –** artefact that combines match making with global database query.

3.	Mueller & Strohmeier (2010)	Theory of Information System	**Virtual Learning Environment** – an artefact for electronically supported corporate training and development.
4.	Adomavicius, Bockstedt, Gupta, & Kauffman (2008)	Process Theory-Design Science Approach	**IT Ecosystem Model** – artefact provides a formal problem representation structure for the analysis of IT development trends.
5.	Jiang & Benbasat (2004)	Design Science – Hevner	**Virtual Product Experience –** an artefact which enables consumers to manipulate web images and view from different angles.
6.	Novak, Hoffman, & Yung (2000)	Hoffman and Novak (2000)	**A Structural Model –** to measure the customer experience in online experience.

2.4.1. Design Theories in Design Science

Theories play a key role in both the natural and the social/behavioural sciences. The natural sciences have advanced primarily through the extensive development and testing of theory, largely through positivist methods. The social and behavioural sciences have also advanced through the development and testing of theory (Venable, 2006b). In the Sciences of the Artificial, Herbert Simon (1996) identified the need for developing various design sciences. A design science is an inventive or creative, problem solving activity, one in which new technologies are the primary products (Simon, 1996).

In IS design science, a design theory is a prescriptive theory based on theoretical underpinnings which says how a design process can be carried out in a way, which is both effective and feasible (Walls et al., 1992). It

offers guidelines or principles that can be followed in practice. Since they are prescriptive, design theories differ from the explanatory and predictive theories found in the natural or physical sciences. The focus of the design theories in the IS community is to improve the effectiveness and utility of IT artefacts in the context of solving real-world business problems (Hevner & Chatterjee, 2010). Table 2.6 lists some design theories developed by design science researchers.

Table 2.6: Design Theories in IS Research

Study	Process
Nunamaker et al. (1991)	The process comprises five stages: (1) Construct a conceptual framework (2) Develop a system architecture (3) Analyse and design the system (4) Build the (prototype) system, and (5) Observe and evaluate the system.
Walls et al. (1992)	Addresses both product and process design. Four components about the design product: (1) Meta-requirements (2) Meta-design (3) Kernel theories, and (4) Testable design product hypotheses. Three components about design process: (5) Design method (6) Kernel theories, and (7) Testable design process hypotheses. Kernel theories are drawn from natural or social sciences, as above, but apply to the design method.
March & Smith (1995)	Design activity consists of: (1) Build (2) Evaluate (3) Theorize (4) Justify

Hevner et al. (2004)	Seven guidelines for Design Science in IS research: (1) Design as an Artefact (2) Problem Relevance (3) Design Evaluation (4) Research Contributions (5) Research Rigour (6) Design as a Search Process (7) Communication of the Research
Venable (2006a)	1. Solution technology invention 2. Theory building 3. Artificial evaluation 4. Naturalistic evaluation
Gregor & Jones (2007)	• The purpose and scope • Constructs • Principles of form and functions • Artefact mutability • Testable propositions • Justificatory knowledge • Principles of implementation • Expository instantiation

The IS literature around design theories is scattered and appears under different labels, such as the constructive approach (Iivari, Hirschheim, & Klein, 1998), the system development approach (Gregor & Jones, 2007; Nunamaker et al., 1991), and the design science approach (Hevner et al., 2004; March & Smith, 1995). The common focus of these design theories is on how an artefact can be built (development process knowledge) and what the artefact should look like when it is built (design principles). The majority of the papers that discuss theory in the context of design science research understand design theory as a prescriptive statement that is a significant output of a research effort.

2.4.2. Design Theories

It is interesting to compare the design science view of design theories

against design theories from the field of design. The former provides guidelines or principles that can be followed in practice, ensuring that the theories are communicated so that they can be understood by practitioners and by other design science researchers. Theory and theorizing/theory building are a central research activity. In contrast, theories from the field of design guide designers in creating effective artefacts. In this section, we discuss some of these theories.

- **Classic Design Theory**

Design is the creation and arrangement of images to communicate a message, opinion, feeling, thought or idea. It incorporates the use of icons, illustrations, colour, lines, shapes, shades and textures (Johnson, 2008). A classic design is one that has stood the test of time. Most classic designs are effortless and straightforward. This theory gives brief descriptions of the elements of design, such as line, shape, space, texture, value and colour, as well as describing the principles of design, which are movement, emphasis, balance and unity (Lauer & Pentak, 1985). These design principles have been used in the creation of fine art as well as commercial art (Wilson, 1966). The **classic theory of design** argues that a work of a designer is pleasing to its viewers as a result of how the **elements of design** are composed in accordance with the **principles of design (Mills & Smith, 1985).** Recognition of these qualities of design has existed for thousands of years, and there is no single source of origin for classic design theory.

- **Gestalt Theory of Design**

The study of gestalt originated in Germany in the 1920s. Much of the theory stems from psychological and cognitive processes. "Gestalt" is used in English to mean "a unified, physical, psychological or symbolic configuration having properties that cannot be derived from its parts" (Courtright, 2002).

Gestalt theories of visual perception were developed by German psychologists in the 1920s. These theories attempt to describe how people tend to organize visual elements into groups or *unified wholes* when certain principles are applied. These principles are similarity, continuation, closure, proximity, figure, and ground (Moore & Fitz, 1993). Gestalt theory discusses how we perceive objects in our environment. It discusses the difference between figure and ground, and examines how various principles help us to decide which is figure and which is ground (Courtright, 2002).

- **Cognitive Load Theory (CLT)**

CLT originated in the 1980s and underwent substantial development and expansion in the 1990s by researchers from around the globe (Paas et al., 2003). CLT is a learning theory of psychology that attempts to explain human behaviour by understanding our thought processes. The assumption is that humans are logical beings who make the choices that make the most sense to them. CLT is sometimes referred to as instructional design theory with the aim of assisting instructional

designers to reduce the load caused by poor design of the learning materials (Cooper, 1998). The theory uses an information-processing approach to cognition, involving working memory, long-term memory and sensory memory (Paas et al., 2003).

- **Pattern Theory**

Ulf Grenander introduced pattern theory in the 1970s. It provided a theoretical setting for a large number of ideas, techniques and results from fields such as computer vision, speech recognition, pattern recognition, image processing, and parts of artificial intelligence (Knill & Richards, 1996). Pattern theory is a mathematical formalism to describe the knowledge of the world in terms of patterns. The software community embraced the pattern vision for its relevance to problems that had long plagued software design in general and object-oriented design in particular. Pattern theory has become one of the most widely used and important ideas of the past decade in software architecture and design (Alexander, 1999).

- **Semiotics Theory**

Semiotics, also called semiotic studies or semiology, is the study of signs and their related processes such as indication, designation, likeness, analogy, metaphor, symbolism, signification and communication (Eco, 1979). In its simplest form, semiotics can be described as the study of signs. These are not signs as we normally think of them, but signs in a

much broader context that include anything capable of standing for or representing a separate meaning.

Semiotics is closely related to the field of linguistics, which, for its part, studies the structure and meaning of language more specifically (Eco, 1979). Semiotics theory proposes that every cultural phenomenon can be studied as communication. It plays an important role in supporting user interface design at the expression level. The design of message content is substantially supported by cognitive psychology (Souza, 1993). Semiotics is important for designers as it allows them to understand the relationships between signs, what they stand for, and the people who must interpret them.

- **Human–Computer Interaction (HCI)**

HCI is not a theory of design per se, but a set of practices that aim to understand how people make use of devices and systems, and how devices and systems can be more useful and more usable (Carroll, 2009). In a sense, it is the application of existing design theories in computing-based environments.

HCI design seeks to discover the most efficient way to design understandable electronic messages, and draws on research from the social and behavioural sciences on the one hand, and computer science and IT on the other. HCI brings these scientists together to figure out how the capabilities of people can be extended through their interaction with and the application of computational technology. Researchers recommend,

for example, the best way to design online menus, icons, forms, data displays, and entry screens.

Given the diversity of users, HCI designers must take into account the different types of users that frequent the system, such as novice users, knowledgeable but intermittent users, and expert frequent users. Each type of user expects the screen layout to accommodate their desires, for example novices need extensive help while experts want to get where they want to go as quickly as possible.

HCI researchers used to be individuals originally trained in engineering and computer science trying to reach a common ground with people trained in experimental or cognitive psychology (Erickson & McDonald, 2008a). Over the past few decades, this aspect of HCI has changed drastically. As computing power has increased tremendously, users are being exposed to more multimedia and devices (Erickson & McDonald, 2008b). As a response to the changes in technology, HCI has changed as well and become more multidisciplinary (Carroll, 2009), since the social, affective, emotional and physical needs of users need to be understood more deeply when designing user interfaces. With the transition of computing technology from the office to the many different social contexts in which people live, HCI has shifted its focus from a narrow view on usability (increasing the efficiency and effectiveness of task completion) to more broadly consider the human experience (Zimmerman & Forlizzi,

2008). Some prominent researchers in this field include Brown (1999), Nielsen (1993), Norman (2002) and Shneiderman (1998).

2.4.1. Summary

A search of the literature did not reveal any design science researchers who have used the design theories described above. This may be because these theories are different from what is commonly understood to be a "design theory" in IS design science. While IS design science theories describe the *procedure* for developing new artefacts (see Table 2.6), traditional design theories provide guidelines for designers so that the designs they produce are aesthetically pleasing, perform their task effectively, and fit well into their overall context. The IS design science theories (methodologies) can be used to develop a new website design process (the goal of this study), but they do not explain how or why the new process will be effective.

The next section examines how design theories can help achieve the goal of developing a website design process that is user-centred, considers the multiple interests of users, and allows users to be consistently involved in the design process. We draw on the evolution in HCI research to guide our search: as it has moved from focusing on the design of elements on computer screens to designing the overall experience of computing, it has expanded the number of theories it relies upon. In the same way, we seek to find the most appropriate framework for incorporating users into the design of their computing experience.

2.5. User Participation in the Design Process

2.5.1. Importance of Users in the Design Process

The success of any e-business interface depends on user participation (Black, 2007; Lille et al., 2009; Terry & Standing, 2004). A successful e-business interface needs to be designed around the needs and wants of the users so that they engage with the site and use it well. There is a growing recognition that providing superior value for users is instrumental for business success (Cagan & Vogel, 2002; W. C. Kim & Mauborgne, 2005; Vandermerwe, 2000).

The concept of the user is fundamental in the research and practice of IS design, development and evaluation. Many software applications are designed around the requirements of the client and the available technology, diminishing the importance of organizational structures and complex social environments (Townsend, DeMarie, & Hendrickson, 2005). As Drucker (2007, p. 172) has pointed out, "customers pay only for what is of use to them and gives them value". Lack of communication between users and developers has been a common theme in the well-documented reasons for failures in IS implementations (Bussen & Myers, 1997). User involvement is likely to result in increased user satisfaction and the perceived usefulness of the application (Terry & Standing, 2004).

In current IS research, however, the notion of user value remains largely unexplored (Lamb & Kling, 2003). The focus of the designers tends to be on technology and the satisfaction of the social context, particularly

people's relationships with those who have requested information or whom they are trying to persuade with information gathered and packaged through the use of technology (Lamb & Kling, 2003).

Moreover, within the complex social settings that commonly constitute organizations, individuals do not always have the opportunity to choose the systems they would prefer to use. As Dray and Seigel (2007) suggest, there is a great need for design to be driven by a deep understanding of users, and their activity patterns, processes, and external influences from society. A deep understanding of users and their mental models can influence specific design decisions, such as the affordances of new products, and may lead to the creation of different and innovative services or products (Dray & Seigel, 2007).

2.5.2. Benefits and Costs of User Participation

User participation is essential from the early stages of the design process to ensure the success and acceptance of products. Users can inspire and inform designers about their needs, desires, capabilities, and limitations at the early stage of the interface design process. A good understanding of users' needs can identify users requirements for new tools or may spark an entirely new product concept (Dray & Seigel, 2007).

User participation is crucial during the initial stage of any design project to understand the direction of the project and visualize the overall outcome (Krieger, 2008). User participation also helps in assessing their

needs and desires. User participation can generate a wealth of ideas that capture the shared knowledge of the user community and reflect community needs more effectively (Krieger, 2008). By recognizing users' needs early on, basic problems can be averted and alternative approaches to difficult designs can emerge. Significant empirical evidence suggests that user participation or collaborative design leads to greater acceptance of outcomes by users. For example, websites have a higher rate of acceptance if users are involved in the design and development process (Kujala & Mantyla, 2000).

However, user participation can also negatively influence project performance. It can make the design process more difficult, lengthier, and less effective because it is time-consuming and could lead to changes in the direction of the overall project (Subramanyam, Weisstein, & M.S. Krishnan, 2010). In addition, users' views may not be aligned with business objectives or designers' requirements. The differences in backgrounds and circumstances between developers and users mean that they usually have different and sometimes conflicting interests during system development (Subramanyam et al., 2010). Designers may be more achievement-oriented, while users may be more interested in satisfactory outcomes. This conflict can be addressed if the level of user participation is decided at the initial stage of the project.

2.5.3. Importance of User Participation for SMEs

Understanding users in the design process is a major issue for both large and small organizations. However, user participation is arguably more important for SMEs compared to larger firms because of their limited resources and knowledge.

Large companies are in a privileged position as they have the resources, time, manpower and budget on design projects. Large organizations may have a team of in-house designers, and have a clearly defined design process for designing websites. Alternatively, they may utilize the services provided by big design firms, such as Better by Design and IDEO, who undertake research activities during the conceptual stage and help the organization to design products and services around the users. For example, 3M designed the transdermal drug dispenser with the help of IDEO (2001), Microsoft designed the first ergonomically designed computer mouse with the help of the same company (IDEO, 1996), and Better by Design successfully changed the identity and packaging of Bluebird Foods (Better By Design, n.d).

On the other hand, SMEs struggle to involve users in the design process because of limited time, budget, knowledge and manpower (Lille et al., 2009). Often, the designing project is given to a freelance designer or to a small design firm, both of whom may have poorly defined processes and not enough resources to invest in understanding the needs of users. Designers, particularly freelance designers, find it difficult to dedicate time to conduct additional user research and perceive that they might

'lose out' when spending extra time and money on user research. Most of the time, designers are under pressure to respond rapidly to design briefs and generate concepts. As a result, the chances that websites they create would not meet their users' needs are high.

SMEs need to make use of the design knowledge that can be gained through user participation in the design stages, because they usually cannot afford the loss of manpower, funds and time invested in the project. Well-designed websites are more important for SMEs because they have fewer opportunities to redo them. Large companies can easily absorb the cost of failure and scrap the project at the initial stage because of their resources. They may have definite contingency plans if the website is poorly designed or fails to perform. SMEs, in contrast, may have limited capacity to have a backup if their website is poorly designed because of their lack of resources.

Table 2.7: Overview of Differences between Large Companies and SMEs

	Large Firms	SMEs
Budget	Large	Small
Dedicated staff	Team or team members, or outside consultancies, dedicated to user research	No dedicated staff
Involvement with user	Large distance from users	Close contact with Users
Communication problems	Between user researchers and designers; between departments	No communication problems
Knowledge of user research Methods	In specialized departments	Often unaware of needs

(Source: Lille et al., 2009)

Table 2.7 summarizes the advantages and disadvantages of being a SME during the design process. As Lille et al. (2009) comment, SMEs have more opportunities to embed the needs of users in their design process when compared with large organizations. Factors such as a flat organizational structure and fewer employees mean that SMEs have good, authentic relationships with their clients and users. This means that SMEs have an advantage in knowing user needs, the details of which can be applied at an early stage of the design process. A design process that integrates the needs of users is more important to SMEs compared to large organizations. However, despite these advantages, very little effort tends to be made by SMEs to engage users in the interface design process (Terry & Standing, 2004). In the next section, various methods of user participation are discussed.

2.6. Methods of User Participation

User participation is not a new concept in IS research – it has long been recognized as a best practice for systems development (Axelsson, Melin, & Lindgren, 2010). While user participation has been covered extensively in the systems development literature (Cavaye, 1995), there are a limited number of studies discussing user participation in website design and even fewer with a focus on SMEs. There are four approaches for encouraging user participation in the design process reviewed below: participatory design (McIntyre-Mills, 2009; Spinuzzi, 2005); collaborative

design (Krieger, 2008); UCD (T. Brown, 2009; Bullinger, Bauer, Wenzel, & Blach, 2010; Garrett, 2002; Norman, 2002); and user innovation (Hippel, 1986).

2.6.1. Participatory Design

Participatory design is characterized by user involvement (Johnson, 1998; Spinuzzi, 2005). Participatory design has its own highly articulated methodological orientation, methods and techniques, as does the participatory action research approach (Spinuzzi, 2005). As the name implies, the approach is about design – producing artefacts, process, work organizations, and tacit knowledge (Spinuzzi, 2005). Participatory design draws on various research methods such as ethnographic observations, interviews, artefacts analysis, and protocol analysis. These methods ensure that participants' interpretations are taken into account during the design process.

Participatory design's main object of study is the tacit knowledge developed and used by those who work with the technology. It is important to understand tacit knowledge, which is typically difficult to describe and formalize. Participatory design aims to ground changes in traditional craft skills as a way of empowering workers. In fact, participatory designers have been cautioned to think of their work as evolution, not revolution (Sumner & Stolze, 1997). Participatory design tends to focus too narrowly on the artefact rather than the overall workflow (Spinuzzi, 2005).

2.6.2. Collaborative Design

Collaborative design is the process of designing in a team that includes designers as well as members of other professions (Kvan, 2000). To some, this is an ideological position, for example those who hold the belief that the only good design method is participatory design.

Collaborative design can be thought of as joint problem solving. It means working with others on shared goals in which the team attempts to find solutions that are satisfying to all concerned. It does not have to be between users and designers in particular (Kvan, 2000). To be successful, a collaborative project must establish a definition of the team, identify their outcomes, ensure there is a purpose for the collaboration, and clarify the interdependencies of the members.

Collaboration requires a greater commitment to a common goal than cooperation, with an attendant increase in risk. Steiner (1972) suggests that in collaborative design, the limitations can be of time, size or place. There can be too many participants or too few to make an effective decision. If there is a lack of understanding and trust in the team, then the project duration increases. Collaboration is mostly done in a computer-supported environment, such as architectural modelling.

2.6.3. User Innovation

The core concept of user innovation is that users are the first to identify the problem and develop a user prototype version of what later becomes a commercial product or process or service (Morrison, Roberts, & Hippel,

2000). In practice, this means that the user is the one who identifies problems and design solutions. Users' ideas are captured through a prototype and then transformed into a real existing product with collaboration between the lead user and designer. Lead users are those who combine two characteristics: 1) they expect attractive innovation-related profits from a solution to their needs, and so are likely to innovate; and 2) they experience needs ahead of the majority of a target market (Hippel, 1986).

Since innovation is known to be an economically motivated activity (Schmookler, 1996), it is reasonable to expect lead users to innovate in a user population, since they will have a higher level of benefit from developing an innovation. Also, lead users are by definition ahead of the bulk target market with respect to their needs, and are an attractively sized market for products and services that may not yet exist from a manufacturer's point of view (Morrison et al., 2000).

Although user innovation design is framed around user perception and experience in terms of attributes, the concept does not go beyond the experience of the lead user (Hippel, 1986). As Hippel (1986) mentions, lead users are not well positioned to accurately identify and evaluate novel product attributes of familiar product that lie outside the world of real-life experience. Moreover, the focus of user innovation is narrowed down to the experience of a lead user and not the target market as a whole. There

is no special mechanism to induce users to identify all the product attributes potentially relevant to the product category (Hippel, 1986).

2.6.4. User-Centred Design (UCD)

UCD is the process of designing a tool, such as a website or an application user interface, from the perspective of how it will be understood and used by a user (Garrett, 2002; Norman, 1982). The basic idea of UCD is that user needs shall dominate the interface design (Norman, 1982), although other aspects concerning the IS, such as functionality and behaviour, also matter in UCD.

According to Fuller (2007), UCD approaches the task of problem solving by seeking to understand end-users' needs, aspirations and goals, and the environmental conditions and constraints in which they live. When we can design a product or solution that meets an unmet need or challenge of the users successfully, that becomes good design (Fuller, 2007). In some UCD projects, designers consult users about their needs and involve them at specific times during the design process, typically during requirements gathering and usability testing. At the opposite end of the spectrum, there are UCD methods in which users have a deep impact on the design by being involved as partners with designers throughout the design process. As Norman (2002) suggests, the role of the designer is to facilitate the task for the user and to make sure that the user is able to make use of the product as intended with minimum effort to learn how to use it.

UCD is a multidisciplinary design approach based on: 1) the active

involvement of users to improve the designers' understanding of users and their task requirements, and 2) the iteration of design and evaluation. It is widely considered the key to product usefulness and usability, and "an effective approach for overcoming the limitations of traditional system-centred design" (Mao, Vredenburg, Smith, & Carey, 2005, p. 105).

The growing popularity of e-commerce has greatly bolstered the appeal of usability and UCD, as users can take their business elsewhere with just one mouse click. Poorly constructed sites can cause half of a website's visitors to shift to another website (Mao et al., 2005). To prevent this, UCD is frequently prescribed. It is useful for developing a user-friendly website (Knobel, 2002), because it incorporates the notion of usability while also focusing on other areas, such as psychology, sociology, graphic design, and cognitive factors (Mao et al., 2005). The next section discusses the multidisciplinary principles used in UCD.

2.7. Multidisciplinary Interface Design

To design a human- or user-centred interface, designers need to understand humans and the mechanism by which they process data. We all think and process data differently, and how data are processed by human minds is affected by many known and hidden factors. If an interface is not well designed for users to interact with, they may simply reject the new possibilities offered (Saariluoma, Parkkola, Honkatanta, Leppanen, & Lamminen, 2009).

One way of addressing the multidisciplinary aspects of design is through uses and gratifications theory (Blumler & Katz, 1974). This theory argues that individuals take an active part in the communication process and because they are goal-oriented in their media use, they actively choose their media products based on their needs. Blumler and Katz (1974) came up with 35 needs based on the social and psychological functions of the mass media, and placed them in five categories: 1) Cognitive needs – acquiring information, knowledge and understanding; 2) Affective needs – emotion, pleasure, feelings; 3) Personal integrative needs – credibility, stability, status; 4) Social integrative needs – family and friends; and 5) Tension release needs – escape and diversion.

While uses and gratifications theory was developed from research in the context of traditional media, such as TV, magazines and radio (McGuire, 1974), it has been extended to the online environment (Luo, 2002). Researchers have used uses and gratifications theory to understand the behaviour and attitude of users, and their social and cognitive needs when using the internet (Cho & Ha, 2011; LaRose & Eastin, 2004; Shao, 2009; Suh, Lim, Kwak, & Pedersen, 2010). Recent studies have measured web usage, and related it to attitudes towards websites and satisfaction (Chen & Wells, 1999; Luo, 2002). These studies of users' attitudes, social behaviour, usability aspects, customer satisfaction, and cognitive requirements contain valuable information for designers when they design websites because they provide insight into how online users become customers, especially loyal customers (Cho & Ha, 2011).

Another way of engaging with the multidisciplinary aspects of design is by using the human-centred design principles of Brown (1999) and Shneiderman (1998). According to them, interface design is a multidisciplinary study because various disciplines contribute to the human decision-making process (Figure 2.4).

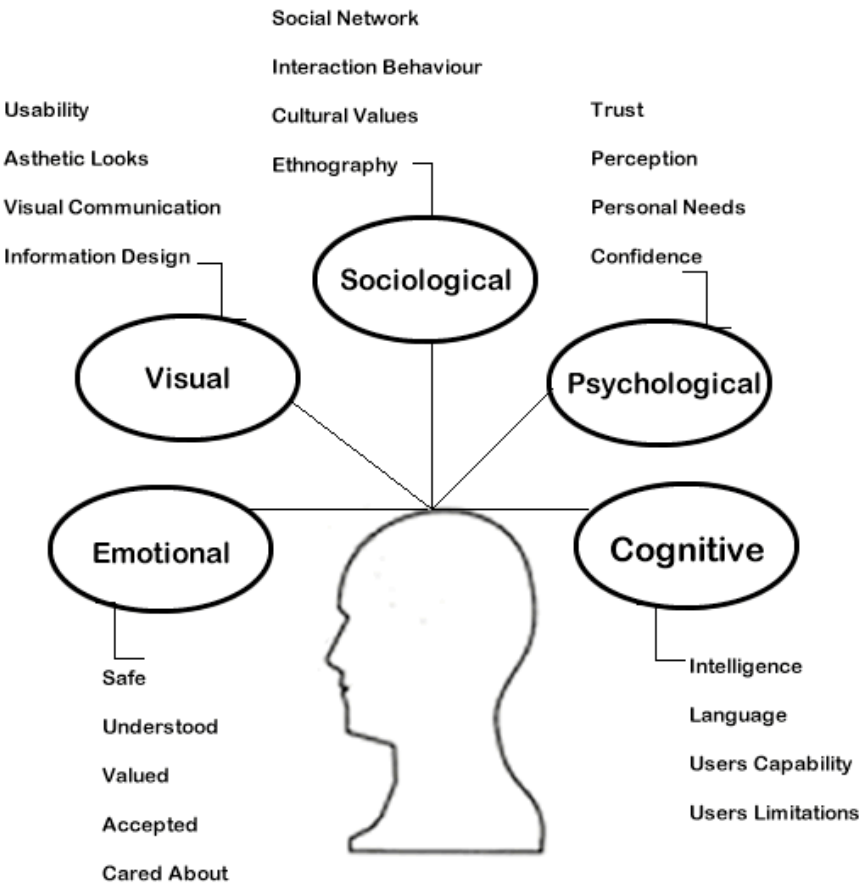


Figure 2.4: Disciplines Involved in User-Centred Design (Sources: Brown, 1999; Shneiderman, 1998)

A user's processing model provides a framework for understanding how systems are used (Brown, 1999). Thus, if designers have a good understanding of these disciplines, they will be able to design interfaces

that will be well utilized. The relevant disciplines are described in the following sections.

2.7.1. Graphic Design (Visual)

Graphics of all kinds are visible everywhere: they invade our every moment, attempt to attract our attention, inform us, and entice us to act. Graphics can put life into invisible things and bring things back to life. The main objective of graphic design is typically to transform concepts into visuals using creativity and design skills. According to Johnson (1997), graphic design consists of three main areas: information design, interactive design, and sensorial design. An effective design covers all the three areas in the design process. As Shedroff (1999) notes, a discipline that communicates through senses is more creative in establishing connectivity with its users. Sound design, musical performance, and vocal communication provide users with not just the information that they seek, but a pleasant experience while shopping (Shedroff, 1999).

2.7.2. Personalization and Design

The key to successful design is grounding the choice of features and tools in the end-users. The first step in the human-centred interaction design process is determining the target user segments of the experience being designed. A personalized design process generates each design through explicit and modelling of users' goal, beliefs and behaviours and ensures

that the resulting design delivers genuine value to the end-users (Kramer, Noronha, & Verga, 2000).

2.7.3. Design and Trust

Trust is both an emotional and logical act. Emotionally, it is where you expose your vulnerabilities to people while believing they will not take advantage of your openness (Aljazzaf, Capretz, & Perry, 2010). Technological advances can replace this but it is still a big hurdle when people interact with businesses and connect with them electronically (Aljazzaf et al., 2010; Ratnasingham, 1998). It has been suggested that the design of the HCI has an influence on the level of trust among potential customers (Egger, 2001; L. Kim et al., 2008; Nielsen, 1993; Norman, 2002). It is the designer of the website who needs to establish what elements of the interface are important for establishing trust in customers (Roy, Dewit, & Aubert, 2001; Wang, 2005).

2.7.4. Psychology and Design

In various forms of interaction design, it is essential to analyse, understand and predict human behaviour. The change in interaction design practice from immediate to delayed interaction, and with a wider group of individuals, makes it necessary to know if and how traditional interaction analysis can really solve design problems (Saariluoma et al., 2009).

Even emotional aspects of users play an important role in building loyalty with them. This has important implications for the design of customer

interfaces in electronic commerce systems, because emotions affect the social interaction process involved in commercial transactions (J. Kim & Moon, 1997). Artefacts carry emotional clues for designers. Identifying the role that artefacts play during product interaction can lead to an understanding of the emotional requirements necessary for a design.

2.7.5. Cognitive Needs and Design

According to Spivey (2007), designing information formats in such a way that the human mind can process the content more effectively is one of the important principles of information design. Understanding the real-time dynamics of how the human mind uses information is a crucial step in solving compatibility issues (Spivey, 2007). Cognitive skills include artificial intelligence, language, memory, perception, learning, development, and attention. Understanding the cognitive skills of users is crucial in designing an effective interface. Spillers (2001) defined cognitive artefacts as physical objects made by humans for the purpose of aiding, enhancing, or improving cognition.

2.8. Use of Multidisciplinary Principles in Design

The above disciplines play a vital role in the interface design process, but little attempt has been made to integrate them in design (Shneiderman, 1998). Researchers have used Brown's (1999) and Shneiderman's (1998) principles in various contexts, such as setting guidelines for visual display, embedding users in the design process, and visualization support in the health sector for creating interactive visual decision tress and designing

multi-sensory displays. Table 2.8 indicates that Brown's and Shneiderman's principles are used mostly for creating effective visual designs and displays. These principles have been used in a wide range of industries, such as health, software development, and graphic design.

Table 2.8: Studies That Have Used Multidisciplinary Principles

No.	Study Title	Key Findings
1.	Protovis: A Graphical Toolkit for Visualization (Bostock & Heer, 2009)	Developed an extensive toolkit for constructing visualizations by composing a simple graphical primitive.
2.	Jigsaw: Supporting investigative analysis through interactive visualization (Stasko, Görg, & Liu, 2008)	Jigsaw provides multiple coordination views of text documents with a special emphasis on visually illustrating connections across different documents.
3.	Data sonification for users with visual impairment: A case study with georeferenced data (Zhao et al., 2008)	Developed an evaluation tool for assisting visual impaired users by exploring data using maps, tables, sound, speech and images.
4.	Verification of Computer Assisted Creativity Assessment System (Fei, Lin, & Chen, 2007)	Research developed a very effective tool which rapidly shortens grading time to assist creativity activities.
5.	Evaluating the Usability of Visual Formalisms (Al-Qaimari, 2007)	Cooperative evaluation plays a crucial role in bringing the designers and the users together in a context that involves the users in the every step of the design process.
6.	Users can change their web search tactics: Design guidelines for categorized overview (Kules & Shneiderman, 2007)	Proposed a set of guidelines for the design of exploratory search interfaces.
7.	Developing Gestalt-based Design Guidelines for Multi-sensory Displays (Chang, 2006)	Introduced guidelines based on a categorization of the multisensory design.

8.	Structured guidelines to support the design of haptic displays (Nesbitt, 2005a)	This paper describes the motivation behind developing guidelines and provides a number of examples relevant to haptic display.

The multidisciplinary frameworks of Brown (1999) and Shneiderman (1998) is broader than the uses and gratifications theory, in that they cover more attributes of users. In addition, they have been used for designing interactive displays in various contexts. The uses and gratifications theory, in contrast, is more useful in contexts where the aim is to compare different websites or to track user reactions over time, i.e. to see how they become loyal customers. Integrating user participation and multidisciplinary principles in the design process increases the quality of the outcome, user satisfaction, and reduces the risk of failure. Given these factors, we decided to use Brown's (1999) and Shneiderman's (1998) multidisciplinary design principles to design a new website design process.

2.9. Conclusion

This chapter has discussed the existing methodologies used for designing websites and their shortcomings. The existing methodologies are narrowly focused on usability, and do not capture the multidisciplinary aspects of design. The chapter also discussed why a new structured website design process was more important for SMEs, because of their limited resources. We conclude by proposing the application of a multidisciplinary framework for designing a new website design process. The next chapter discusses the research methodology used for designing the artefact.

Chapter 3

Research Methodology

Introduction

The research strategy is discussed in this chapter. It details how the design process (artefact) was developed and evaluated using various techniques. As stated previously, the goal of this study is to develop a website design process for SMEs that incorporates a broader range of users' needs. To answer the research question, the study used a design science build/evaluate approach (Hevner et al., 2004). The focus is not on evaluating the outputs of the design process but on the methods and the frameworks used to integrate users' needs in the website design process.

3.1. Choice of Methodology

Research methodology is defined as the philosophy of a research process that includes the assumptions and values that serve as a rationale for research and the standards or criteria the researcher uses for interpreting data and reaching a conclusion (Basili, Selby, & Hutchens, 1986). Basically, a research methodology applies a scientific method to solve a research problem (answer a research question). The main aim of research within the IS discipline is to study the effective design, delivery, use and impact of IT in organizations and society. When trying to decide which research methodology to apply, we considered the methodologies that are

frequently used in IS.

There are two distinct paradigms of research in IS: behavioural science and design science (March & Smith, 1995). The behavioural science paradigm has its roots in natural science research methods. It seeks to develop and justify theories that explain or predict organizational and human phenomena surrounding the analysis, design, implementation and use of IS.

Action research is known by many other names, including participatory research, collaborative inquiry, action learning, and contextual action research (Brien, 1998). It is used in real situations, rather than contrived, experimental studies, since its primary focus is on solving real problems. In accordance with its principles, it is mostly chosen when circumstances require flexibility, the involvement of the people in the research, or change must take place quickly or holistically (Brien, 1998).

It is often the case that those who apply this approach are practitioners who wish to improve understanding of their practice, social change activists trying to mount an action campaign, or, more likely, academics who have been invited into an organization (or other domain) by decision makers aware of a problem requiring action research, but lacking the requisite methodological knowledge to deal with it (Winter, 1989).

Design activities are central to most disciplines. Research in design has a long history in many fields including architecture, engineering, education, psychology, and the fine arts (Cross, 2001). The design

research paradigm is highly relevant to IS research because it directly addresses two of the key issues of the discipline: the central, albeit controversial, role of the IT artefact in IS research (Weber, 1997), and the perceived lack of professional relevance of IS research.

The research methodology used in this thesis is design science (Hevner et al., 2004) because the goal is to design a new artefact for designing systems. While routine design is the application of existing knowledge to organizational problems, design science involves finding new solutions to previously unsolved problems or better and more efficient solutions to previously solved problems (March & Smith, 1995).

3.2. Design Science Methodology Applied to the Artefact

Hevner et al. (2004) provide a framework for research activities in design science within the IS discipline and a clear set of guidelines or principles for conducting and evaluating good design science research.

Table 3.1: Guidelines for Design Science Research

Guidelines	Description
1. Design as an artefact	Design science research must produce a viable artefact in the form of a construct, a model, a method or an instantiation.
2.Problem relevance	The objective of design science research is to develop technology based solutions to important and relevant business problems

3. Design evaluation	The utility, efficiency and quality of a design artefact must be rigorously demonstrated via well-executed evaluation method.
4. Research contributions	Effective well design science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations and design methodologies.
5. Research rigour	Design science research relies upon the application of rigorous methods in both the construction and evaluation of the design artefact.
6. Design as a search process	The search for an effective artefact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
7. Communication of research	Design science research must be presented effectively to both technology oriented and management oriented audiences.

(Source: Hevner et al., 2004)

According to Hevner et al. (2004), effective design research must provide clear contributions in the areas of design artefacts, design construction knowledge, and/or design evaluation methodologies. Researchers, reviewers and editors must use their creative skills and judgement to determine when, where and how to apply each of these guidelines. As Hevner et al. (2004) suggest, each of these seven guidelines should be addressed in some manner for design science research to be complete. They are therefore discussed below in detail.

3.2.1. Design as an Artefact

The result of any design research is a purposeful IT artefact created to address an important organizational problem. The artefact must be described effectively, enabling its implementation and application in an

appropriate domain. According to Weber (1997), the theories of artefacts are fundamental to the IS disciplines. We do not conceive of IT artefacts independently of people or the organizational and social contexts in which they are used, but as interdependent and co-equal with them in meeting business needs.

There is one clear artefact produced by this research, the design process used to create an e-business website. The artefact is created by integrating the principles of human-centred design and usability in the SME environment. The artefact serves three groups: users, the designer, and the owners of the artefact.

3.2.2. Problem Relevance

A problem can be defined as differences between a goal state and the current state of a system. According to Simon (1996), problem solving can be defined as a search process using actions to reduce or eliminate the differences. The role of e-business is growing significantly in the SME environment. Maximum benefit from e-business can be achieved when the website is designed effectively by integrating the needs and wants of users. From the literature review (Chapter 2) it is evident that there are no clear methodologies to integrate the emotional, psychological, and other needs of the users in the design process. The usability aspect has been integrated in the website design process but human-centred design needs to go beyond usability. This need has been recognized but not

implemented in practice. This is the very relevant problem addressed by this research.

To verify the problem's relevance, 10 designers from different backgrounds such as website designers, software designers, academia, and graphic designers were surveyed on the need for a new design process. The study questionnaire (Appendix A.1) was drafted based on the criteria discussed by other researchers in their designer papers (Brown, 1999; Egger, 2001; Garrett, 2002; Humphreys et al., 2008; J. Kim & Moon, 1997; Kramer et al., 2000). The theory behind selecting multiple evaluators is that a single evaluator could miss many problems while a number of different evaluators will potentially find different problems.

3.2.3. Design Evaluation

The utility, quality and efficiency of a design artefact must be rigorously demonstrated through a well-executed evaluation method. As Hevner et al. (2004) point out, evaluation is a crucial component of the research process. A design artefact is complete and effective when it satisfies the requirements and constraints of the problem it was meant to solve. The evaluation of design artefacts typically uses methodologies available in the knowledge base. Evaluation methods such as observation, analytical, experimental, testing, and descriptive methods can be used.

Hevner et al.'s (2004) observation method was used for evaluating the design process (see Chapter 5). Three evaluation tools were used for evaluating the artefact: an in-depth interview, user task analysis (think

aloud), and expert review analysis. The intention of the evaluation is to find out whether the design process built in this study can embed the needs of users in the final product. Users and designers have evaluated both the product and the process. User task analysis was used to evaluate the usability aspect of the website; the in-depth interview evaluated the needs of users based on multidisciplinary principles; and expert heuristic analysis provided comparison results between existing design processes and the new design process developed in the research study. Details of the evaluation process are discussed in section 3.3 and in Chapter 5.

3.2.4. Research Contribution

Effective design science research must provide clear contributions in the areas of the design artefact and design construction knowledge, such as foundation, or design evaluation knowledge and methodologies. The ultimate assessment of any research is "what are the new and interesting contributions?" (Hevner et al., 2004). This study contributes on the different levels of design science research contributions identified by Gregor and Jones (2007): an artefact (level 1), design principles (level 2), and an emergent design theory (level 3). Full details are presented in Chapter 6.

This study has also integrated evaluation methods to evaluate websites that are designed based on users' needs. This triangulated evaluation process is also one of the contributions of this research and is used in evaluation of both the product and the process.

3.2.5. Research Rigour

Rigour in design research relates to the way in which research is conducted. Design science requires the application of rigorous methods in both the construction and evaluation of the designed artefact (Hevner et al., 2004). In both behavioural science and design science research, rigour is derived from the effective use of the knowledge base, theoretical foundations, and methodologies. Success depends on the researcher's skilled selection of appropriate techniques to develop or construct a theory or artefact and the selection of appropriate means to justify the theory or evaluate the artefact (Hevner et al., 2004).

The present study has theoretical foundations in both IS design and human-centred design principles. The new design process was developed from a thorough search of the relevant literature review and the identification of the shortcomings of existing methodologies (see Chapter 2). To address the gap, multidisciplinary design principles (Brown, 1999; Shneiderman, 1998) were used to develop the artefact (see Chapter 4). The new artefact was instantiated through a case study. Evaluation of the artefact was done rigorously using multiple methods (see Chapter 5).

3.2.6. Design as a Search Process

Design is essentially a search process to discover an effective solution to a problem. Problem solving can be viewed as utilizing available means to reach desired ends while satisfying laws existing in the environment (Simon, 1996).

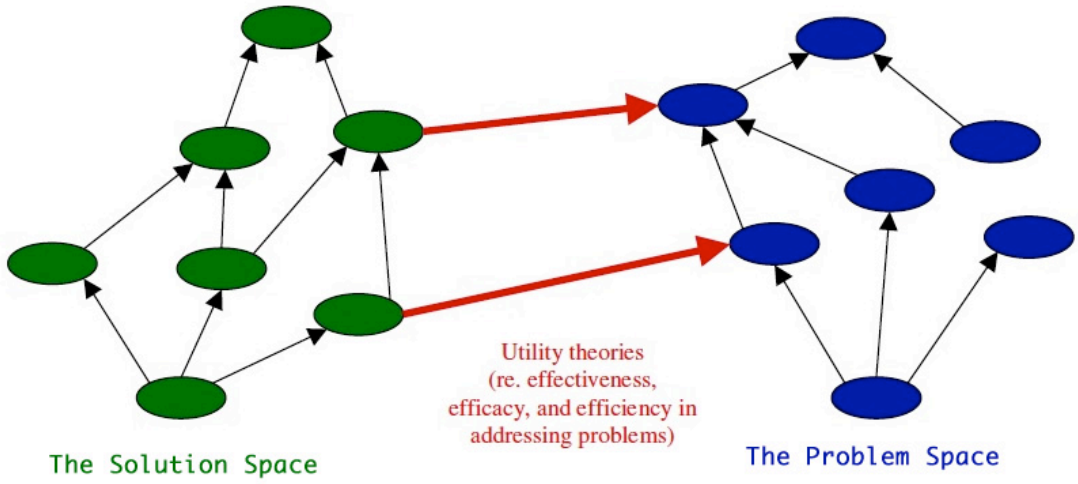


Figure 3.1: Components of Utility Theories

(Source: Venable, 2006b)

In Figure 3.1, the problem space represents the lack of understanding in IS of various design theories from other disciplines such as classical design theory, cognitive design theory, and semiotics design theory, and of the importance of integrating the design process. As mentioned in Chapter 2, various design theories have been put forward in IS (Gregor & Jones, 2007; Hevner et al., 2004; March & Smith, 1995; Pries-Heje et al., 2008; Simon, 1996; Venable, 2006a; Walls et al., 1992). The common focus of IS design theories is how to undertake the building of an artefact (development process knowledge) and what the artefact should look like when built (design principles). Design science research has traditionally not drawn on theories from the design discipline because it focuses on

theory as a set of practices to be followed when building an artefact, while traditional design theories provide guidelines or principles for designers to ensure their artefact meets its goals.

In Figure 3.1, the solution space represents a design process where the needs of the users are integrated in the design process. Users are involved in the design process from the very start of the project. The concept of the user is fundamental in the research and practice of IS design, development and evaluation. User involvement is likely to result in increased user satisfaction and the perceived usefulness of the application (Terry & Standing, 2004). User participation can generate a wealth of ideas that capture the shared knowledge of the user community and reflect the community needs more effectively (Krieger, 2008).

In Figure 3.1, utility theories (kernel theories – theories from other field) make an assertion that a particular type or class of technology (i.e. a meta-design) – whether it is of an IS or other system, software, a modelling language, a development or planning method or other procedure, an algorithm, or any other form of technological solution – has (some level of) utility (or usefulness) in solving or improving a problematic situation (with specified characteristics) (Venable, 2006b). In this study, the utility theories that are used for solving the problem are human-centred design theories (Brown, 1999; Shneiderman, 1998) concerned with understanding how people make use of devices and systems, and how devices and systems can be made more useful and more usable (Carroll,

2009). HCI design research has shifted its focus from a narrow view on usability – increasing the efficiency and effectiveness of task completion – to more broadly considering the human experience (Zimmerman & Forlizzi, 2008).

3.2.7. Communication of Research

Design science research must be presented both for technology-oriented and management-oriented audiences (Hevner et al., 2004). Technology-oriented audiences need sufficient detail to enable the described artefact to be constructed, while management-oriented audiences need sufficient detail to determine if organizational resources should be committed to constructing and using the artefact within their specific organizational context.

This study provides clear information to both the designer and owners of the website by involving them in the multiple stages of the design process. The research communicates and demonstrates clear benefits to the owners of the website in SME area and the designer of the website regarding the benefits of integrating the users' emotional, cognitive, and psychological needs at various stages in the design process. The next section discusses the third guideline, Design Evaluation, in detail.

3.3. Evaluation of Artefact through a Case Study

After being designed, the artefact needed to be evaluated.. We found a firm and a designer that were willing to deploy this method. The client of the designer was a sports organization called Play Atlantic. Play Atlantic

is an online recruitment agency for students want to make a career in sports. The new artefact was implemented in the design of Play Atlantic's new website. Once the website was completed, evaluation was carried out using multiple methods. Full details of this case study are presented in Chapter 4.

Hevner et al. (2004) list five different evaluation methods. They are described below:

1) Observational:

a. Case Study: Study the artefact in a business environment

b. Field Study: Monitor use of artefact in multiple projects

2) Analytical:

a. Static Analysis: Examine the structure for static qualities (e.g. complexity)

b. Architecture Analysis: Study the fit of the artefact into the IS architecture

c. Optimization: Demonstrate inherent optimal properties of the artefact or provide optimal bounds on artefact behaviour

d. Dynamic Analysis: Study artefact in use for dynamic qualities (e.g. performance)

3) Experimental:

a. Controlled Experiment: Study artefact in a controlled experiment for different qualities like usability

b. Simulation: Execute artefact with artificial data

4) Testing:

a. Functional (Black Box) Testing: Execute artefact to discover failures

b. Structural (White Box) Testing: Perform coverage testing of some metric in the artefact implementation like execution paths

5) Descriptive:

a. Informed Argument: Use information from the knowledge base (e.g. relevant research) to build a convincing argument for the artefact's utility

b. Scenarios: Construct detailed scenarios around the artefact to demonstrate its utility

As the design process developed in this research is the first of its kind, we used a soft observational evaluation method (case study) for evaluation. A case study suits the research well because the research is related to more how and why questions and is based around the social phenomena of users (Yin, 2009). The main purpose of the case study is to investigate the case in relation to its historical, economical, technological, social, and cultural contexts. It provides an good opportunity for researchers to get insights from the minds of users during the design process. A single case study was used to evaluate the artefact. in this research. Methodological guidelines for conducting positivist case study research in IS such as construct validity, internal validity, reliability and external validity were followed (Shanks, 2002).

3.3.1. Data Collection

In order to answer the research question, the researcher collected the data from a client, a designer, and five users during the website design process of a SME website. A SME was selected that suited the purpose and

objective of the study. The criteria used for selecting an SME for this study were:

- The SME must be either redesigning or building a new e-business website.
- The management should be open to provide access to its designer and users.

Along with primary data, the researcher also used the requirements analysis documentation, the wireframe designed by the designer, and their interview notes during data analysis.

As this research required the participation of human respondents, certain ethical issues were addressed. Utmost care was taken regarding the rules and regulations concerning ethics in research. During this stage, all ethical standards set by the Auckland University of Technology Ethics Committee (AUTEC) were adhered to. The researcher took into consideration professional integrity, privacy, and confidentiality during the data collection process. Informed consent was gained from all participants before they were interviewed. The participant's information sheet approved by AUTEC was provided to all participants involved in the study.

3.3.2. Instrument to Collect Data

The aim of qualitative data collection is to try and understand the issues being researched and explain the impact they have on people's behaviour and ways of thinking. There are many qualitative data-gathering

techniques such as in-depth interview, focus group, narratives, document studies, and observation. We will discuss three that are particularly suitable when users are part of the study.

Table 3.2: Comparison of Various Qualitative Techniques

Factors to consider	In-depth Interview	Focus Group	Observation
Sensitivity of subject matter	If the subject matter is sensitive, the respondents will not temper responses or withhold information.	If the subject matter were sensitive, the respondents would be unwilling to talk openly in a group.	If the subject matter is sensitive, the respondents may alter their behaviour.
Depth of individual responses	A greater depth of response per individual is desirable with the complex subject matter and very knowledgeable respondents.	Most of the respondents can say all that is relevant or all that they know in less than 10 minutes.	The depth of the information cannot be observed for a longer period of time as respondent may experience fatigue.
Extent of issues to be covered	A greater volume of issues can be covered.	The volume of issues to cover is not extensive and limited to the main issue.	Only non-verbal issues can be covered and no scope of probing.
Continuity of information	Provides scope to understand how attitudes and behaviours link together on an individual basis.	A single subject area is being examined in depth and strings of behaviours are less relevant.	Provides scope to understand respondent's behaviour for a limited time.
Group interaction	Group interaction is likely to be limited or non-productive.	Group interaction of respondents may stimulate a richer response or new and valuable thought.	Less scope for group interaction during observation period.
Emotional and cognitive aspects	Afford ability to experience the affective as well as cognitive aspects of responses.	Respondents may not show any reactions, as they are in a group setting.	Does provide limited scope for understanding emotional and cognitive behaviour.
Quality of data	Rich and in-depth.	Rich but suits to a specify issues such as political discussion.	Rich and mostly non-verbal data.

(Sources: Abras et al., 2004; Jeffries et al., 1991; Preece, 1994)

All qualitative techniques are good for data collection but the suitability depends on the nature and scope of the research project. Among the three techniques described in the Table 3.2, in-depth interviews were the best match for this study as users and human factors were involved. In-depth interviews can provide an in-depth knowledge of issues that are sensitive for respondents. As Peerce (1994) noted, interviews enable designers to evaluate the user's likes and dislikes about the design and to gain a deeper understanding of any problems.

Thus, in-depth interviews were used to collect data and evidence in this case study. They allowed the researcher to focus directly on the topic at hand and generated causal inferences and explanations from users and the designer during the design process. The questions that were asked were open-ended, and the interviews were more similar to conversations than structured questioning. As stated by Holstein and Gubrium (1995), in-depth interviews are more interactive and collaborative and much less directive than survey interviews. Interviews were audio-taped and transcribed for data analysis.

3.3.3. Planning for In-depth Interviews

There were three rounds of interviews at three different stages of the design process. The first round was carried out during the initial stage. All the participants were interviewed. The main objective of this round was to identify the business's objectives, requirements, purpose and target market; participants' needs and wants for the e-business website; the

timeframe; and the designer's design process. Each interview lasted about 30 minutes. Based on the feedback from the interviews, the designer designed the wireframe of the website.

The second round of interviews was conducted when the designer had designed the wireframe based on the initial requirements from round one. The purpose of this round was to test whether the wireframe met the users' needs. Only the users were interviewed in round two. These interviews were more detailed and each interview took about 45 minutes. Based on the feedback from round two, the designer made the necessary changes to the website.

The final round of interviews was conducted at the evaluation stage of the design process. This set of interviews – again with the users only – was part of the evaluation process for the artefact (the design process). An interview protocol was used when interviewing the users so that the researcher could compare their responses with their earlier comments. The objective of the interviews was to obtain users' views about the success of the design process and the overall outcome. Each interview took about 30 minutes. The details of interview protocol are provided in Chapter 4. The final step in the design process is to evaluate the artefact, which is the subject of the next section.

3.4. Evaluation of the Artefact

The artefact was evaluated by using three evaluation tools: user task analysis ("think aloud"); in-depth interviews; and expert review analysis.

The objective of the evaluation was to find out the whether the design process developed in this study was successful in embedding the needs of users in the final product.

Step 1: Data Collection

3.4.1. User Task Analysis – "think aloud"

The user task analysis helped us to see how users interacted with the website and led to a more efficient and effective website design. A complete description of the tasks, sub-tasks, and the methods required to use a website in order to perform tasks were provided to users (Wright & Monk, 1998), and users were evaluated on their ability to carry out these tasks.

3.4.2. In-depth Interviews

During the final implementation stage of the project, users were again interviewed to examine the success of the project. An interview protocol based on Brown's (1999) and Shneiderman's (1998) principles was used to assess if there were any differences of opinion from the second round of interviews.

3.4.3. Expert Review Analysis

An expert review analysis is most often conducted to evaluate a system interface. It is a type of analytical evaluation in which an expert in user interaction design assesses a particular user interface by determining

what usability design guidelines it violates and supports (Nielsen, 1993). Expert review analysis was conducted using two methods; a survey and interviews. Surveys are cost-effective, less time-consuming, and have a high response quality, while interviews provide more detailed information than what is available through other data collection methods such as focus group. Combining both methods enabled us to capture the experts' views holistically. Full details about the evaluation are provided in Chapter 5.

Step 2: Data Analysis

The final step in the research method approach is analysing the qualitative data collected. Data analysis was done in two steps: coding and pattern matching.

Coding

Data analysis started during interviews and continued during transcription, when recurring themes, patterns and categories became evident. The data was coded, organized and labelled for interpretation. Coding means the features, instances, issues and themes in the empirical data are classified and given labels (Miles & Huberman, 1994). Coding is the major step in analysing qualitative data. Data was coded into meaning categories enabling the researcher to organize large amounts of text and discover patterns that would be difficult to detect by just listening to a tape or reading a transcript. The collected data was carefully read, and then initial coding was conducted by generating numerous category codes and labelling the data using NVivo software. NVivo helped to code and

categorize large amounts of narrative text collected from the open-ended interviews. It also helped determine whether any meaningful patterns were emerging.

Analytical Technique

According to Yin (2009), there are four main analytical techniques for data analysis in case studies. The first is called *pattern matching*, and involves finding patterns from empirical data collection and comparing them with the propositions pre-developed on the existing theory. *Explanation building* involves an iterative search process for causal links in the empirical data, which are then presented in the narrative form. The third technique is called *time series analysis* and focuses on detailed tracing of events over time. The *Logic model* technique focuses on complex chains of events, which are staged in repeated cause-effect-cause-effect patterns. For this study, the pattern matching technique was used for data analysis.

Interview data was transcribed and organized into strips using NVivo. Collected interview data was analysed strip by strip to identify any patterns of themes and categories. Key categories were used for coding the data and the identification of salient points or structure. Each transcript was read several times to get a sense of the whole and engage with the words of participants. Data was systematically arranged that explained some relevant social, psychological, emotional, or other phenomenon relevant to the study.

The quality of research design was maintained at all levels of the data collection and analysis phases. A chain of evidence was maintained for the validity of the data. The initial database of interviews was preserved and the time and place of each interview was indicated in the recorded audio file. To minimize error and bias in the study, an interview journal was maintained throughout the entire research.

3.5. Conclusion

This chapter identified design science as a suitable approach for this study, as the focus is on the construction of an artefact. Hevner et al.'s (2004) research framework was used for this study. The application of the new design process was done through a case study, and the artefact was evaluated with multiple methods. The next chapter provides detail on how the artefact was designed and instantiated using a case study approach.

Chapter 4

The Design of the Artefact

Introduction

The goal of this study is to build a new website design process that integrates multidisciplinary design principles (Brown, 1999; Shneiderman, 1998). This chapter provides details of how the artefact (the "Multidisciplinary Design Process") was designed and instantiated in a case study. The following sections explain the process used for designing the website. As mentioned in Chapter 3, the new design process involved three rounds. The first two rounds were designing the website and using the artefact, and the third round was the evaluation of the artefact. The first two rounds are presented in this chapter and last round is discussed in Chapter 5.

4.1. Design of the New Process

Designing a new design process begins by identifying existing methodologies (Abels et al., 1998; Garrett, 2002; Lowe & Eklund, 2002; Nielsen, 1993; Spinuzzi, 2005). As Chapter 2 established, the existing web design methodologies are narrowly focused on the usability aspects of design. HCI and the SDLC do not feature strongly due to the nature of the web application development environment: time schedules for

development are relatively short – often less than one or two months (French, 2011; Valacich, 2012; Lopatovska & Arapakis, 2010).

From our review of the literature, we found that multidisciplinary design, based on Brown's (1999) and Shneiderman's (1998) principles, could help broaden the focus of website design. The new design process presented here integrates usability principles and the multidisciplinary principles of design. This is achieved by adding an additional step to the existing design process (see Table 4.1; Figure 4.1).

To create a design process that can integrate usability and other needs such as psychological, cognitive and social needs, we used two rounds of user interaction. Using two rounds in the design process provides an opportunity to integrate usability and multidisciplinary needs in seperate rounds. Although other web design methods also use mutliple rounds in design, their focus does not change much from usability. In the first round, we used interviews to integrate the usability principles (Garrett, 2002; Nielsen, 1993; Norman, 2002) and the client's (management's) needs. After the wireframe was developed, the users were again interviewed to see if the interface met their broader (multidisciplinary) needs using an interview protocol. The interview protocol is presented in Table 4.3. The feedback from the interviews was provided to the designer so that he could modify the website. Thus, the new artefact integrates the business objectives and the anticipated needs of users in the design process.

Table 4.1: Steps Involved in the Multidisciplinary Design Process

	Task Performed	By Whom
	• Round One of the Design Phase:	
1.	Obtaining clients requirements	Researcher and Designer
2.	Obtaining users requirements	Researcher
3.	Collating and summarizing the feedback	Researcher
4.	Designing wireframe	Designer
	• Round Two of the Design Phase:	
5.	Collecting feedback from users using interview protocol and the wireframe	Researcher
6.	Collating and summarizing the feedback	Researcher
7.	Re-designing the website	Designer
8.	Evaluation of the website	Researcher

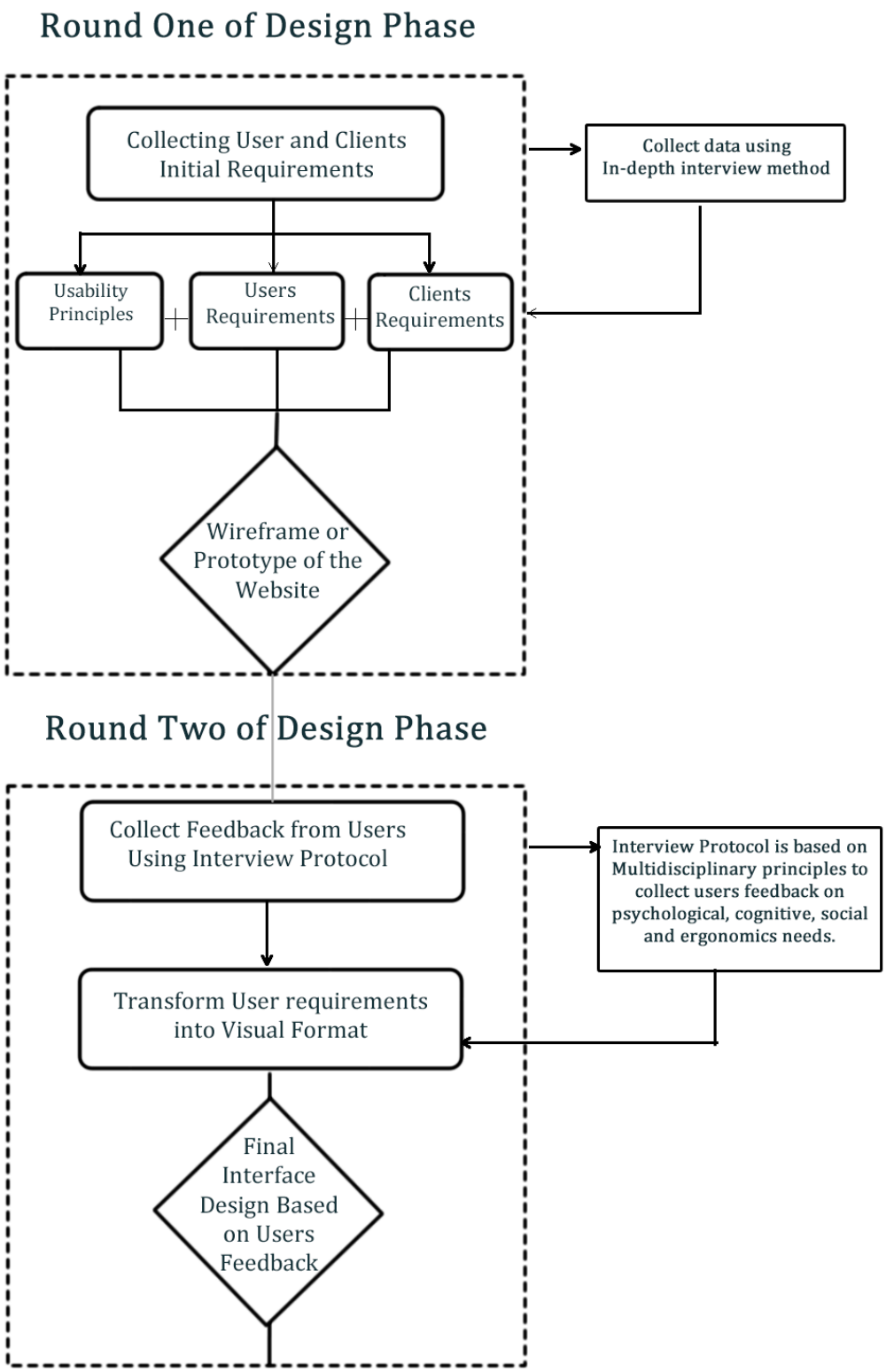


Figure 4.1: The Multidisciplinary Design Process

4.2. Instantiation of the Multidisciplinary Design Process

After designing the new process, we used a case study to assess its applicability. Around 15–20 designers were contacted by cold-calling to see if they were interested in participating in the study, and whether they had a contract to design a website for an SME client. A designer was selected who was willing to participate and met this criterion.

The client of the designer was a sports organization called Play Atlantic. Play Atlantic is an online recruitment agency for students and coaches who are passionate about sport and want to make a career in sports. Play Atlantic's primary objective was to be the most affordable, comprehensive, client-, coach- and user-friendly recruiting agency on the market. Play Atlantic was formed in 2003 by a group of former coaches and players who had been through recruiting process as students and then worked on the "other side" as coaches. It is an online recruiting website that recruits college students and offers opportunities of scholarship with US universities. Students can enrol with the company to get professional coaching and a chance to study at an American university. The main sports promoted by the organization are golf, soccer, tennis and football. Play Atlantic was suitable for this study because as it was a small organization that wanted to redesign their website. It had an existing website (see Figure 4.2) but it was not appealing to their target market. The website was static and management wanted to create a fresh look that integrated the requirements of its target market. Management had

identified a clear set of target users: students, coaches and parents. Management was willing to provide access to its designer and users.

Figure 4.2: Old Website of Play Atlantic

The client had contracted the designer to redesign its website. The designer was a small design agency with three graphic designers and one account manager. The allocated designer had experience in both print and digital design, and was willing to participate in the study as it provided an opportunity to gain more knowledge in web design.

4.3. Design Process: Round One

Data Collection: Round one consisted of collecting the requirements of clients and users and providing them to the designer. The interview questions were about their expectations for the website, and were based on usability principles and user requirements (Axelsson et al., 2010; Nielsen, 1993; Norman, 2002; Troyer & Leune, 1998; Virzi, 1996) (see

Table 4.2). The interview protocol was pre-tested by the researcher on friends to check for clarity and understanding.

Group One – SME Management: The management of the SME provided information about the objective, purpose, target audience and content requirement of the website to the researcher and designer. Three target markets for the website were identified: tertiary student athletes between the ages of 17 and 20, professional coaches, and parents. The primary focus is on students involved in soccer, golf and tennis.

Group Two – Designer: The designer is the person who designed the website for the client. The client contracted the designer.

Group Three – Users: After the target market was identified by the client, the researcher selected five users who were willing to participate in the study based on the criteria provided. The users were selected because they were familiar with the internet and had some interest in sports. In order to maintain consistency, data was collected from the same users throughout the design process. The target groups for the interview were identified by the client, and the personal network of the researcher and referrals were used to recruit the individual participants such as coaches, students and parents. The participants were two students, two coaches and a parent. Each interview took about 30 minutes.

Table 4.2: Background Information on Participants

Participants	Background	Topics Covered
User 1 (Student 1)	Studying in College and plays table tennis regulary in a club. Has a passion for table tennis and wants to build a career in table tennis.	Interview questions covered information related to the expectations of user from a website, user preferences, needs and requirements, how they relate or connect to the website and user interaction preferences. Second round of interview consists of more focused questions on psychological, cognitive, social and personal needs around website.
User 2 (Student 2)	First year University student playing soccer for the last 6 years. Want to see if love for soccer can be combined with the studies. Also looking for a good coach.	
User 3 (Coach 1)	Coaches soocer for a club and faciliates team to play inter club tournament.	
User 4 (Coach 2)	Part time net ball coach for a school. Wants to travel and explore for the opportunity for coaching in different countries	
User 5 (Parent)	A parent, whose daughter is a excellent net ball player in school and for a club. Very sport oriented family.	

Table 4.2 provides information on participants background and the topics covered during interview. The interviews with the client and the designer were conducted in the designer's office. The interviews with the participants were conducted in public places, such as cafés or public libraries. Further details on the interview process are provided in Chapter

3. The researcher ensured that the participants understood the nature of the study and the benefits of the study.

Table 4.3: Sample Interview Questions from Round One

Sample Interview Questions
Users
1. What are your expectations from a website?
2. What are the indicators of trust in a website?
3. How far your needs and requirements were considered during design process in other websites?
4. How do we make our website better so that it can integrate all you needs and desires?
5. Will it make any difference if users are part of the interface design process? How and why?
6. At what level does the overall design of the other websites values your cultural and social norms?
Designer
1. Are there any specify criteria that need consideration when designing for SME? Eg: nature of users, resources, time limit etc.
2. What is your design process when designing a website?
3. What process do you go through to determine users' needs, feeling, their moods and requirements?
4. What are your thoughts of integrating users in the initial stage of design process?
5. What kind of challenges will you be facing if users are involved in the design process? Does it help to create more effective interface?
SME Management:
1. What is the objective of the website?
2. What image of your organization you want to convey to your user through your website?
3. Who are your target groups?
4. What is your opinion about including the users in the interface design process?

4.3.1. Results from Round One

Design Phase:

The designer was provided with the feedback from the interviews as well as information on usability design principles (Nielsen, 1993; Norman, 2002). A summary of the feedback from the SME's management and the users was also provided to the designer. The designer received content and images from the client.

NVivo was used for analysing the interview data. In Figure 4.3, the *y* axis represents nodes that were used for coding and the *x* axis represents the percentage of nodes found in the data. The transcribed data is included in Appendix A.2.

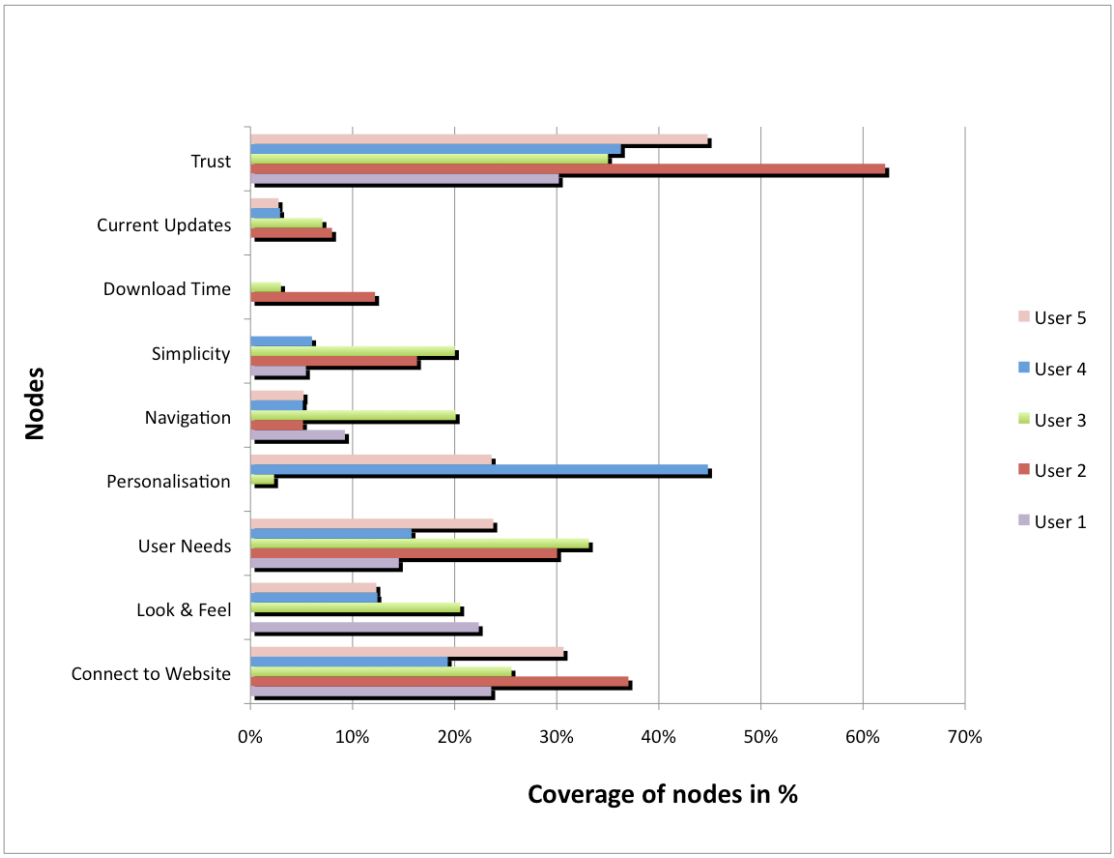


Figure 4.3: Results from Round One of the Interview Process

The results of the analysis indicated that trust is the main factor for users across all three groups when using the website. Trust includes confidence in the content of the website and in the organization itself. Users were less concerned about the visual design and the navigation of the website. It was surprising to find that users focused on trust rather than usability issues, such as navigation, look and feel, download time, and simplicity. Therefore, the website needed to establish connectivity and build trust with users in order to build user confidence.

Feedback from users ranged from the aesthetics of the website to connectivity and bonding with the organization. Users wanted the website to be simple, informative, interactive and elegant, so that they would not be "lost" in the process of finding required information.

Users said they would revisit the website if it was rich in content, and graphically different with various shapes, easy to navigate, and enjoyable to use; it should download quickly, especially the images and interactive content. The usability of the website was important for creating a first impression but trust and personalization were also important factors for users. For some users, colour and layout mattered but the more important aspect was that the website should be able to deliver whatever it was promising.

Some users preferred a personal contact link for creating trust, while others preferred a feedback form. The website also needed to have background information on the organization and its achievements. To

create a feel of confidence in the content, users wanted reviews from students and parents about their experiences with the firm. The reviews needed to be current and updated frequently, as this created confidence and made the website feel more genuine. Information presented on the website needed to be accurate, not just marketing "buzz". Users also recommended having external information on the organization's achievements, such as newspaper articles, reviews on university websites, comments on sports websites, reviews from sport personalities, or testimonials from other students and parents. Parents wanted to know more about affiliations with other sports bodies or universities, as that added credibility to the organization. Since youths between 17 and 19 are influenced by their friends and peers when making decisions, the users asked for social networking features, such as Facebook, Twitter and YouTube links, to be incorporated in the website.

According to the client's feedback, the main objective of the website was to enrol students for coaching and create a strong database in order to attract professional coaches. With this aim in mind, the website needed to provide an image of professionalism and create trust among users for them to invest in training. It was intended that the website would include a profile of each student and a video of their performance, with a form for the student to evaluate and sign off the information. This information would then be marketed to coaches, who would also have a profile page and access to the student section. They would be able to read the profiles of students to ascertain whether they were interested in coaching them.

Parents would be able to access information about the organization, the various membership packages, and organizational achievements. As mentioned, it was important that the website presented a professional image so as to inspire trust and confidence in parents so that they would invest in their child's sports career. The client mentioned that the home page should look as though the designer had taken care and made a lot of effort.

Based on the feedback provided by the researcher, the designer designed wireframes and provided them to the client for feedback. Figures 4.4 and 4.5 show sample wireframes.

Figure 4.4: Wireframe 1

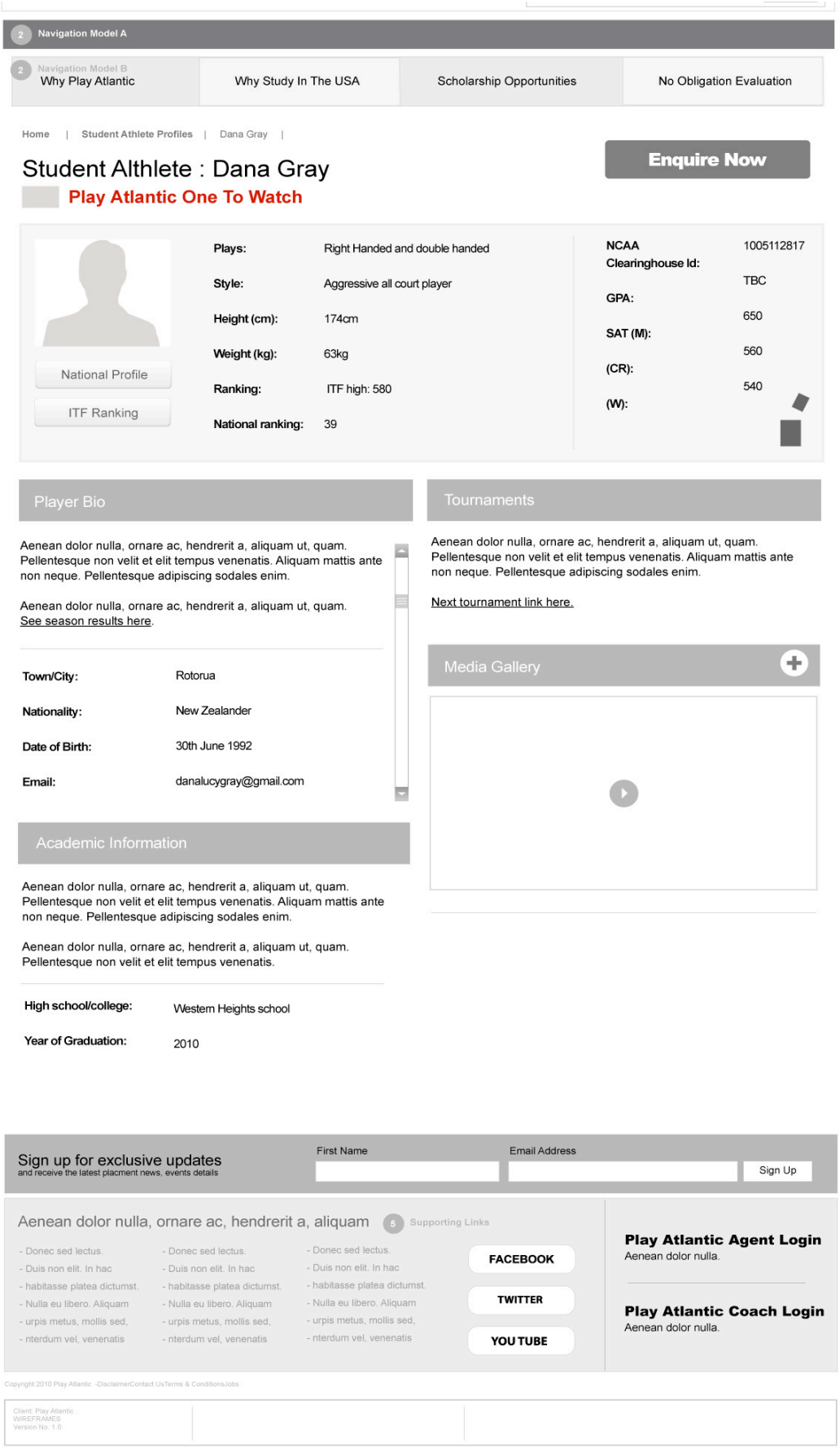


Figure 4.5: Wireframe 2

After receiving approval from the client for the initial wireframes, the designer integrated the design, colour and look and feel into the wireframes. Figure 4.6 shows the final wireframe.

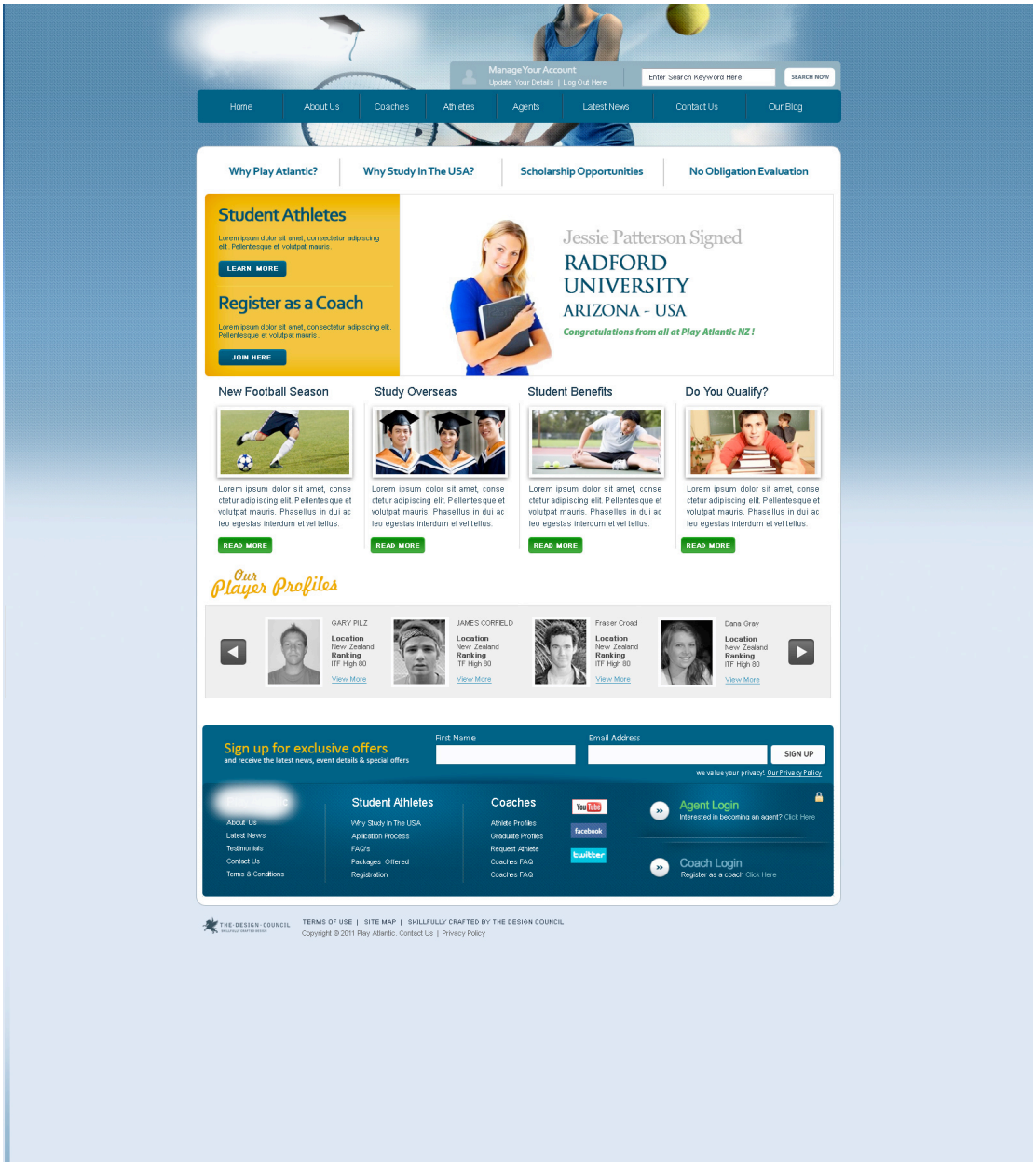


Figure 4.6: Final Wireframe

4.4. Design Process: Round Two

In this round, users were asked for their feedback on the wireframes (see Figures 4.7, 4.8 and 4.9). The interview questions were based on the multidisciplinary principles and consisted of five questions from each of the psychological, personal, sociological and cognitive disciplines (Table 4.4).

Table 4.4: Interview Protocol

Personal Preferences 1. How well do you think the designer of the interface understands your needs and requirements? (For example: your likes and dislikes) 2. What level of trust and confidence do you have in the organization, after interacting with the website and looking at its graphics? 3. How do you think the designer has integrated various tools and features in the design? (Such as blog, online feedback form, search option and viewing other students profile) 4. Explain the level of customer service you get from using this interface? 5. How well does the website allow you to perform functions such as finding information about coaches, students, watching the player or facility to get more information?
Psychological Questions 1. Explain any challenges such as navigating, analysis, or solving interaction, you face when you interact with the interface? 2. Do you have any emotional response when looking at this website such as curiosity, happy, challenged, fear or boredom? 3. Explain if website promotes any positive reinforcement and motivation? (Sense of motivation and acceptance) 4. When you are working with this interface what are your thinking regarding the comfort level you experience? 5. Describe if the website creates a feeling of belongingness and connectivity? (Feeling of belonging and attention)
Cognitive Questions 1. How would you describe the interface, in terms of simplicity of its use such as screen reflectivity, software and hardware required? 2. What kind of challenges are you facing during navigation of the interface such as language used in the website or do you need to adapt to a new learning style

to use the website? (Doesn't requires artificial intelligence)

3. How do you feel about the information density and time taken to process? Especially the combination of visual images and text.
4. What is your opinion about the visibility and clarity in the overall layout of the interface? (For examples: size and colour of text, arrangement of content, number of clicks to find information)
5. How well is the interaction organized in this interface? Do you feel mentally challenged or confused?

Sociological Questions

1. Is the designer of interface aware of your social networking habits, your environment and your culture? (Such as Facebook, YouTube, online interaction, watching demo video, texting, chatting)
2. Does the interface challenge your cultural, social or family values?
3. How does the interface encourage building links and bonds with other users? What value do these have?
4. Would you suggest to others to visit the website in your community? Why?
5. What do you think regarding the quality of language used in the interface?

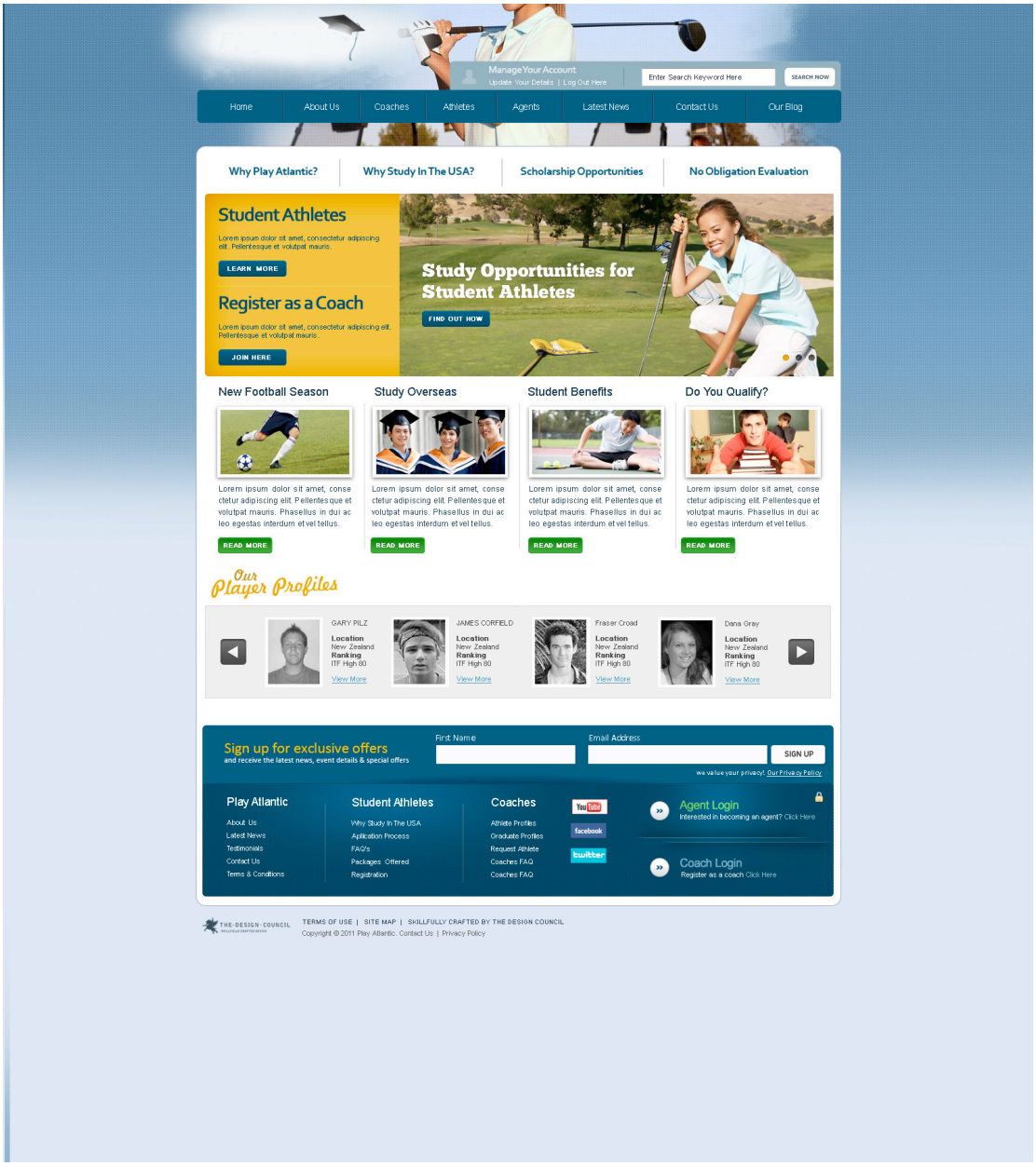


Figure 4.7: Wireframe 1 after Round One

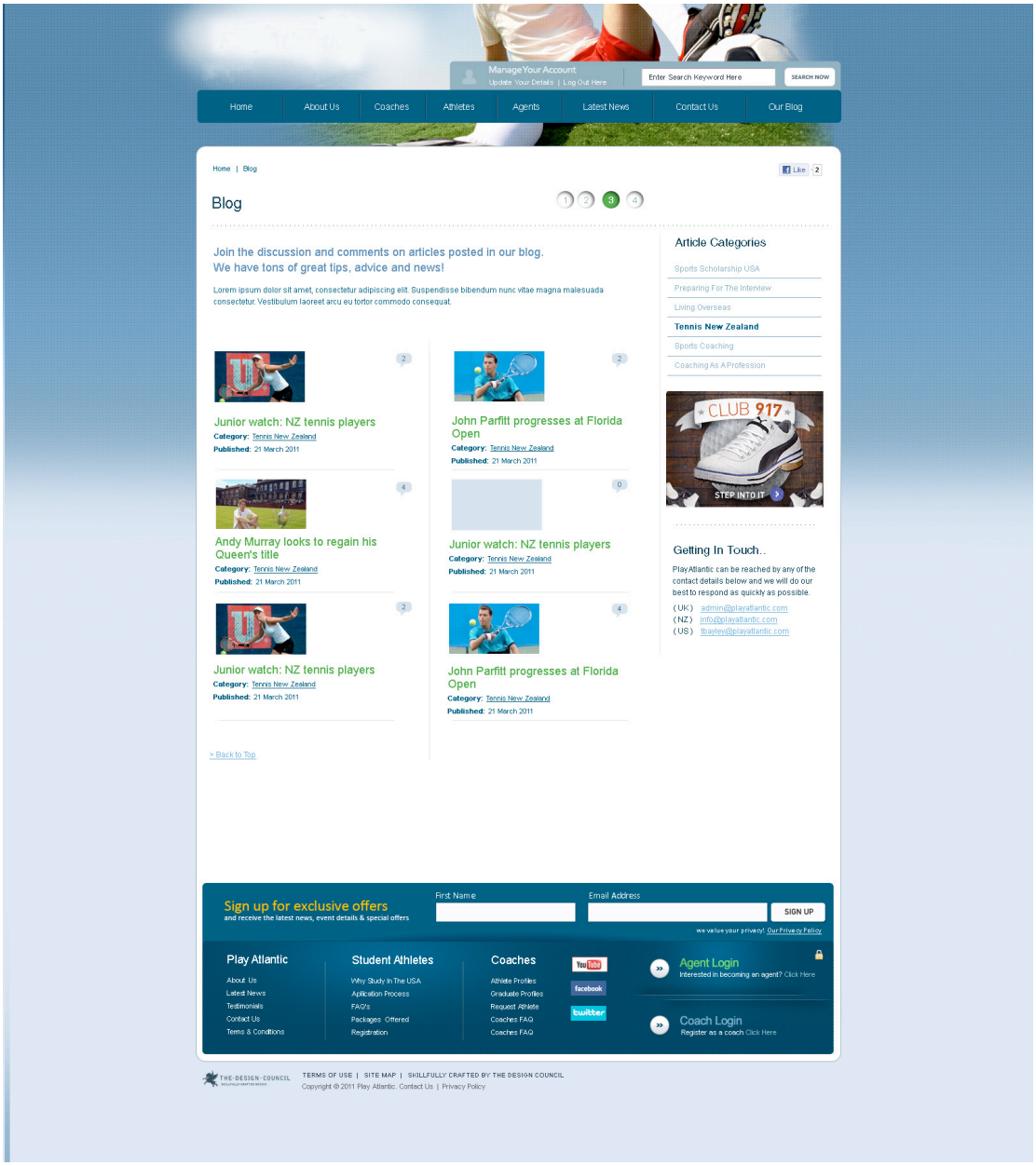


Figure 4.8: Wireframe 2 after Round One

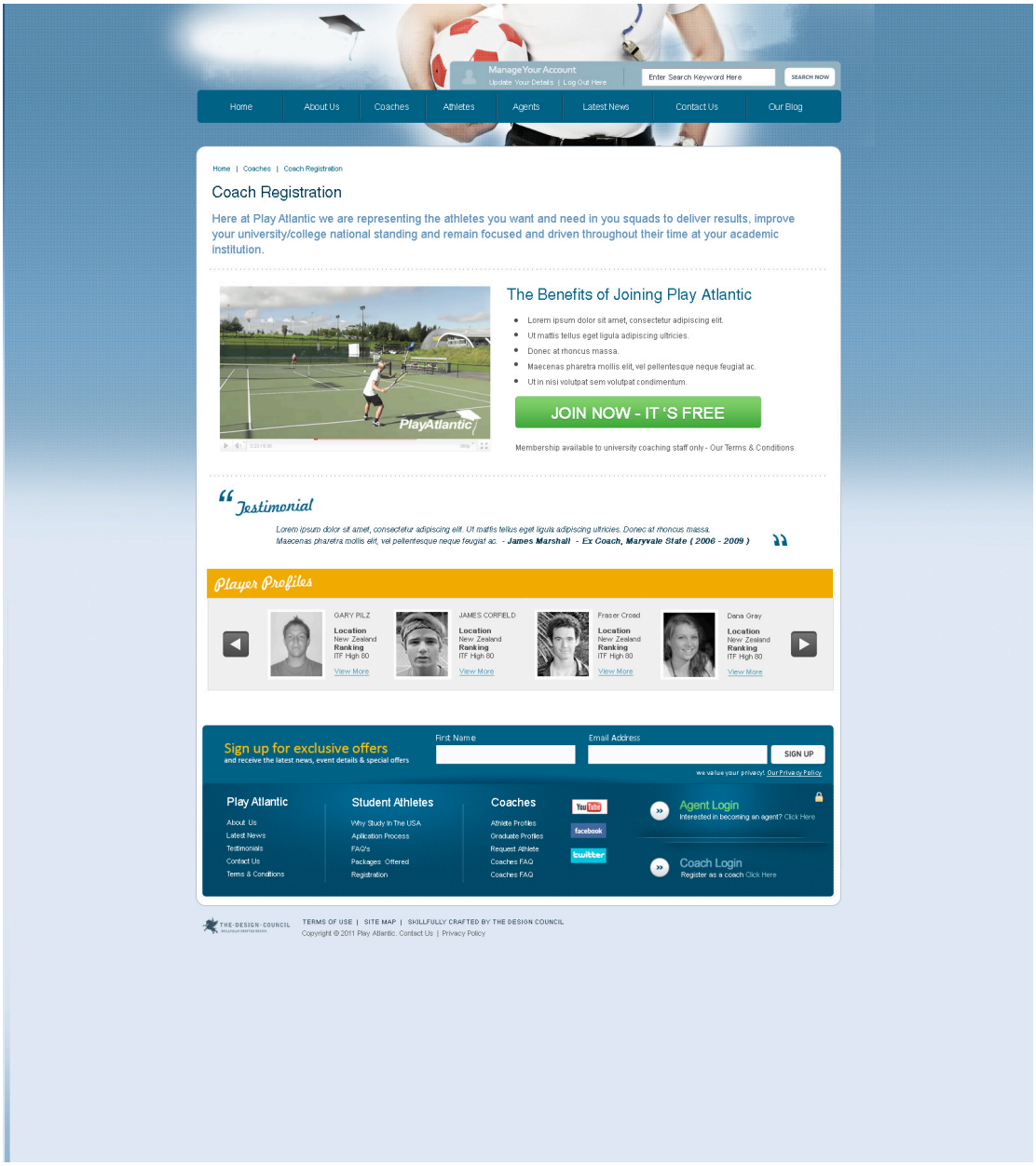


Figure 4.9: Wireframe 3 after Round One

4.4.1. Results from Round Two Interviews

The interviews were transcribed and coded using NVivo. By detecting themes and pattern matching, the results were grouped into different nodes. The transcribed data is included in Appendix A.3.

The results were grouped by the type of discipline: personal values, psychological values, cognitive values, and sociological values. The themes

were selected on the design principles of Brown (1999) and Shneiderman (1998).

- **Personal Values**

Personal values of the users towards the website related to the language of the content, tasks performed on the website, arrangement of the content, and features of the website.

The website made an effort to connect with its target market by using YouTube, Facebook, a blog and Twitter. Teenagers like to be socially active and to connect with them it is important to use their communication networks. Most of the users were pleased with the robust and detailed needs of the users that had been integrated such as a call-back option and comments in the coaches' section. From the parents' perspective, the information was right on the home page. The website had various options for users to interact with the organization or the students such as phone numbers, feedback form, blog and "sign up". Users felt that the designer had valued their requirements and integrated them into the design. Users usually avoided filling in an online form, but the website provided a form where they just have to enter their email address and password. They appreciated the efforts of the designer to get to know the users and build the website accordingly. The website was very elegantly designed with good colours and layout; users had an impression of a sophisticated corporate environment.

Placing questions such as “Why Play Atlantic?” and “Why study overseas?” on the home page of the website made the parents feel that their needs were valued. Navigation, interaction and information was well organized and the users felt that the designer knew what they would be looking for on the website. One of the most important goals for users was to be able to navigate through the website easily. Upon seeing the interface, users felt that the navigational hierarchy was well organized and that they could navigate easily. The website acknowledged the fact that people needed to be guided through the hierarchy:

> *“I think there is an acknowledgement that people need to be guided by the hierarchy of the page and that has been done pretty well.” (Coach)*

One of Neilsen’s (1993) usability principles is to know your users and understand their navigation and learning styles when using website. This principle was well acknowledged in the website.

The home page of the website was not overcrowded and there was plenty of white space. The website provided the impression that the organization was large, sophisticated and well-equipped. Users received the impression that the designer valued them as a person and had added relevant information. Involving users and making them feel part of design process creates a sense of belongingness and increases the acceptance level of the website (Nielsen, 1993).

The customer service was excellent on each page with details of navigation, how to contact for more information, and links to external

sources. Users were pleased how the designer integrated the initial feedback provided in round one of the design process. They felt confident and motivated to come back for further updates.

Users felt that a few of their personal preferences were lacking, however. Some hassle was created because there was no search option where they could find their friends and see their status before registration. A few users considered the blue colour of the website as boyish and masculine. Users felt that the website needed more information on credentials of the organization and its achievement in order to build trust. A FAQ section needed to be in the top navigation panel as users really do not read the entire website, they just glance.

- **Psychological Values**

Psychological values of the users towards the website include users' knowledge, thinking, reaction, intuition, memory, and pleasurable experience.

The first impression the website created was one of a large and well-organized company. Most of the users felt it was easy to find information on the website. The initial presentation of the website encouraged users to look further into it. Questions such as "Why Play Atlantic?" and "Why study overseas?" provided peace of mind to the parents. Most of the users felt the layout created a sense of assurance. The website provided an impression that the organization had good contacts with the other institutes and coaches.

The users felt reassured because they could look at each student, their achievements, progress and testimonials on the website. This provided an insight into the organization's activities. It also added an emotional touch to the website. As the information was clearly laid out, with the user's profile, the various membership packages offered, parents' information, and information about organization, parents felt that they could trust the organization.

> *"I find that these links are very easy, once I went to this link then I go to coaches, it is similar layout I guess the idea of the way this is working. And because everything is in this boxes so you know that all the content will be here." (Student)*

The design of a website's interface and easy-to-use features play a role in building loyalty with users (J. Kim & Moon, 1997).

The website has separate login section for coaches and students, providing a sense of personal identity and belonging among users. The users felt very comfortable using the website. The layout and navigation felt familiar and there was no learning curve involved to use the website.

According to a coach, the website was well organized, reliable, elegant, and sophisticated but lacked the emotional highs and lows of sport. The website reflected a sense of calmness, which was not a true reflection of sports. It lacked emotive pictures, stories, and any expression of students' journeys:

"I have to say that it is a website well organised and presents facts but I don't really see any evidence, the kind of emotional high or low that you get from succeeding or failing in the sports. It is all very matter of fact. So I think that on the one hand I am praising that it is well organised and feel reliable and good use of hierarchy and all, on the other hand it is very matter of fact and it is always a bit of a gamble." (Coach)

Users experienced some confusion with the headings such as "about us", "students", "athletes" and especially "blog". This could be challenging for parents who are not frequent users of computers. There was not much information on the company's credentials or affiliations with overseas universities.

- Cognitive Values

Cognitive values of the users include artificial intelligence, language, memory, perception, learning, development and attention when interacting with the website.

The website was very simple and practical to use – with a few clicks, one could access the information needed. The fonts and colours were well chosen so that users felt confident and enjoyed the journey. The navigation was user-friendly and finding the information was not stressful. The navigational hierarchy was logical and focused on making a right decision. Most of the users felt the layout was simple and required no special skills to use:

> *"I think it is not anything that I am not familiar with. It is not using weird navigation thing, it seems quite simple, don't have to try and re learn anything, quite easy." (Student)*

Designing the website in such a way that the human mind can process the content more effectively is one of the important principles of information design (Spivey, 2007). Remembering the task and going back and forward was not challenging. Things were made easy for users as top navigation was always there on the page. This reduced the chances of getting lost on the website. The clarity of the website was good as it was not overcrowded and had plenty of white space. There was a good contrast between text and background and there was no strain on the eyes or neck to read the content.

One of the users felt that it might be a challenge to find important information, such as student packages or FAQ's, as they were located at the bottom panel. The information was there but users would not look at the bottom of the site to find important information. Pull-down or drop-down menus would be helpful under the "students" or other sections:

> *"I have to go down and click there. But if it is a drop down menu, some websites I like it where you just pull down and say a menu and then it shows different areas, you can directly go into that rather than click. " (Parent)*

Understanding the behaviour of users when using websites and their navigational pattern is crucial in designing an effective interface (Spillers, 2001). The website had clear navigation and a site map so there was no question of getting lost. The only problem was that the font was not well

suited for the screen. Users needed a search button in the students' profile section so that they could look for somebody they knew before they registered and feel more confident about doing so.

- **Sociological Values**

Sociological values of the users towards the website include their cultural and social background, values, community values, things they care about, family values, and environmental values.

The designer had responded to the current teenage social network trends by including Facebook, YouTube, a blog and Twitter. The website did not provoke any issues related to social, cultural or family values. A few users felt that the colour blue was more American than New Zealand:

> *"It looks quite American, I mean that sense of sporting establishment." (Parent)*

There were many features in the website which tried to build connectivity with the organization such as the blog, Twitter, the "sign up" section and the feedback forms. They provided every opportunity to users to connect and be part of the organization. Users commented that they would recommend this website to others who are interested in a sports career.

> *"If I meet anybody if they are interested in scholarship then I would say, go to that site, as there are a range of sports and very thorough and gives all the information you need." (Coach)*

Parents would be interested in the organization as the website was about universities and sports. The website provided an impression of the

organization as being of a substantial size and professional. The design and content of the website was up to social and sports academy standards. It did not look amateur and gave the impression that there were strong people behind the organization.

4.5. Changes in Design

Some changes were made to the website after the feedback from the second round of interviews was taken into consideration. From the cognitive aspect, a drop-down menu and bottom navigation were provided, so that users had two options to navigate the website. If users were focusing on the top section of the page, they could use the drop-down menu, and if they were focused at the bottom of the page, they could use the bottom navigation. Since some users were unable to concentrate on the information as the animation was too fast, the animation on the home page was slowed down.

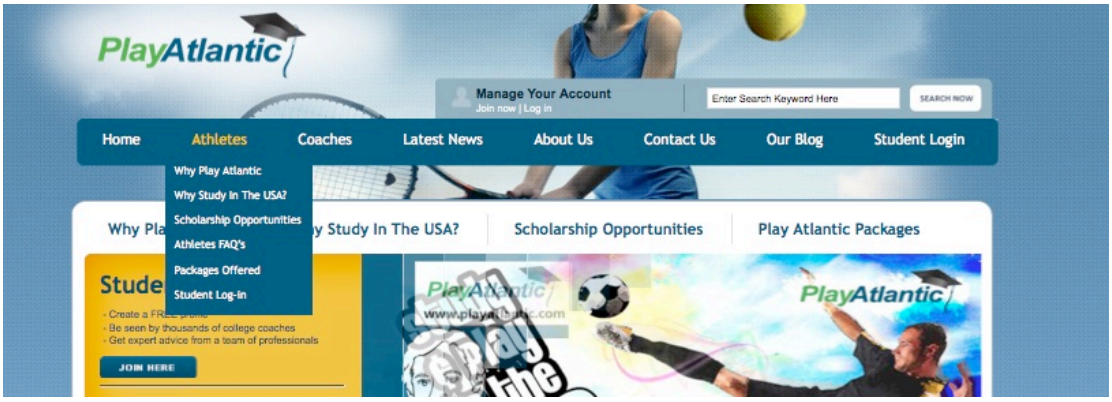


Figure 4.10: Screenshot of Drop-Down Menu on the Final Website

From the personal aspect, parents preferred to see the information on membership upfront and not hidden in the sub-sections of the website. They wanted the organization to be upfront about its costs so that no hidden tactics would be used to enrol students. This would increase the credibility of the organization. Thus, the Membership Packages section was added to the navigation menu on the home page.

Figure 4.11: Screenshot of Membership Packages Section

In terms of the users' psychological and emotional needs, there were some comments from users regarding the affiliation of the organization with American universities. They wanted testimonials from these universities so that they could be confident about the organization. Thus, a new section was added called "Why Study in the USA?". It included comments from the affiliated universities and newspaper articles on them. The final design also had a new "updates" section, where updates on various universities was provided. Finally, more information on the organization was provided in the "About Us" section as the users wanted to know more about the organization so that they would feel assured about its credibility.

Figure 4.12: Screenshot of the Section about Other Universities

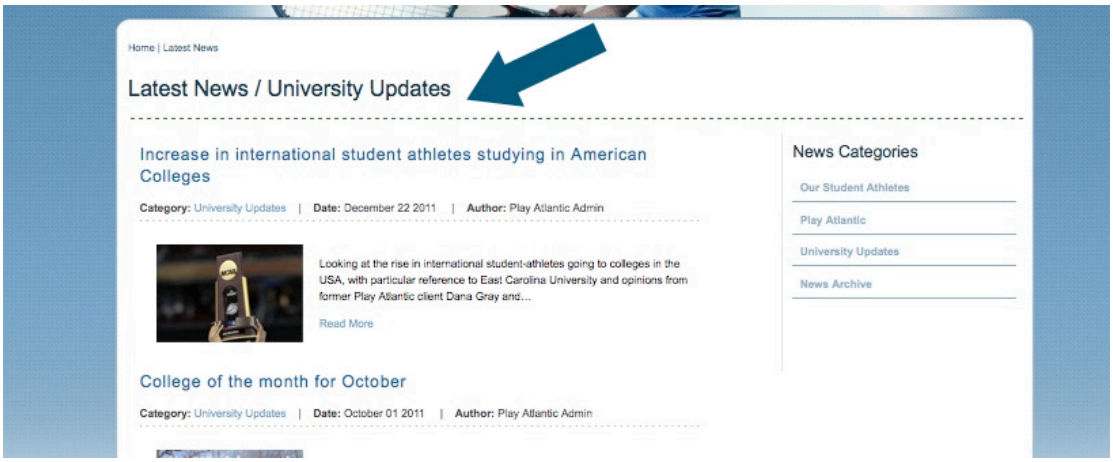


Figure 4.13: Screenshot of the University Updates

4.6. Conclusion

This chapter described the new design process and its instantiation in a case study with a SME firm. The various steps of the case study process were detailed, and how the website design evolved to take into account the users' feedback was explained. The next chapter describes the process used for evaluating the Multidisciplinary Design Process and the website.

Chapter 5

Evaluation of the Artefact

Introduction

This chapter describes the process used to evaluate the artefact. The intention of the evaluation is to find out whether the design process built in this study embeds the needs of users. The artefact was evaluated in three ways: in-depth interviews, user task analysis, and expert review analysis. The in-depth interviews were used to evaluate the product (website) and the process, the user task analysis was used to evaluate the product (website), and the expert reviews were used to evaluate the design process. The chapter begins by discussing how evaluation has been conducted within design science.

5.1. Evaluation in Design Science Research (DSR)

Starting from the early contributions by Simon (1996) and March and Smith (1995) on design as a science, a variety of IS researchers have provided valuable approaches for DSR strategies, practices and processes. Of most relevance are the studies by Hevner et al. (2004) and his colleagues Walls et al. (1992), Takeda, Veerkamp, Tomiyama, and

Yoshikawa (1990) and Carlsson (2005), which offer valuable advice on how to proceed in the evaluation of DSR process of artefacts.

Evaluation in DSR is concerned with evaluation of design science outputs, including theory and artefacts. Walls et al. (1992) introduced the notion of discrete testable hypotheses for explicitly evaluating two components of IS design theories: the design process and the design product (meta-design) in their ability to achieve meta-requirements. They provide no guidance on how to evaluate, although they seem to advocate a positivist approach.

March and Smith (1995) emphasize evaluation as one of the two activities in design science: build and evaluate. Evaluation incorporates the development of criteria and the assessment of the artefact's performance in comparison to the criteria. Beyond simply establishing that an artefact works or does not work, evaluation also has a responsibility to determine how and why it works (or not), for example by using natural science methods for theorizing about IT.

Among their seven guidelines, Hevner et al. (2004) require researchers to rigorously evaluate design artefacts. They summarize five kinds of evaluation methods: observational, analytical, experimental, testing, and descriptive. However, they do not provide much guidance in choosing among the various evaluation methods.

Table 5.1: Examples of Evaluation Approaches in Design Science

Author & Year	Artefact	Evaluation Method
Valverde, Toleman, & Cater-Steel (2011)	Conceptual model	Bunge-Wand-Weber model
Bragge, Tuunanen, Virtanen, & Svahn (2011)	Collaboration method for new technology fields	Interview users
Wiener & Stephan (2010)	A client-driven method for offshore software development	• Observation method • Interview
Peffers, Tuunanen, & Rothenberger (2008)	Develop and present a DSR methodology	Interview method – Laddering method
Isbister (2006)	Sensual evaluation instrument	• Questionnaire • Think aloud • Emo cards
Ahmed, McKnight, & Oppenheim (2006)	User-centred Design and evaluation Methodology	• Competitive analysis • User task analysis • Heuristic evaluation

Table 5.1 shows that there are different ways to evaluate artefacts in design science. Little work had been done to guide the choice of evaluation strategies until the publication of a comprehensive article by Pries-Heje et al. (2010), which integrated a large proportion of existing work on DSR.

Pries-Heje et al. (2010) proposed a strategic framework for DSR evaluation that is useful in analysing published studies and in surveying the evaluation opportunities that present themselves to IS DSR researchers. A strategic framework serves (at least) two purposes: it can be used to help design science researchers build strategies to evaluate their research outcomes and to achieve improved rigour in DSR.

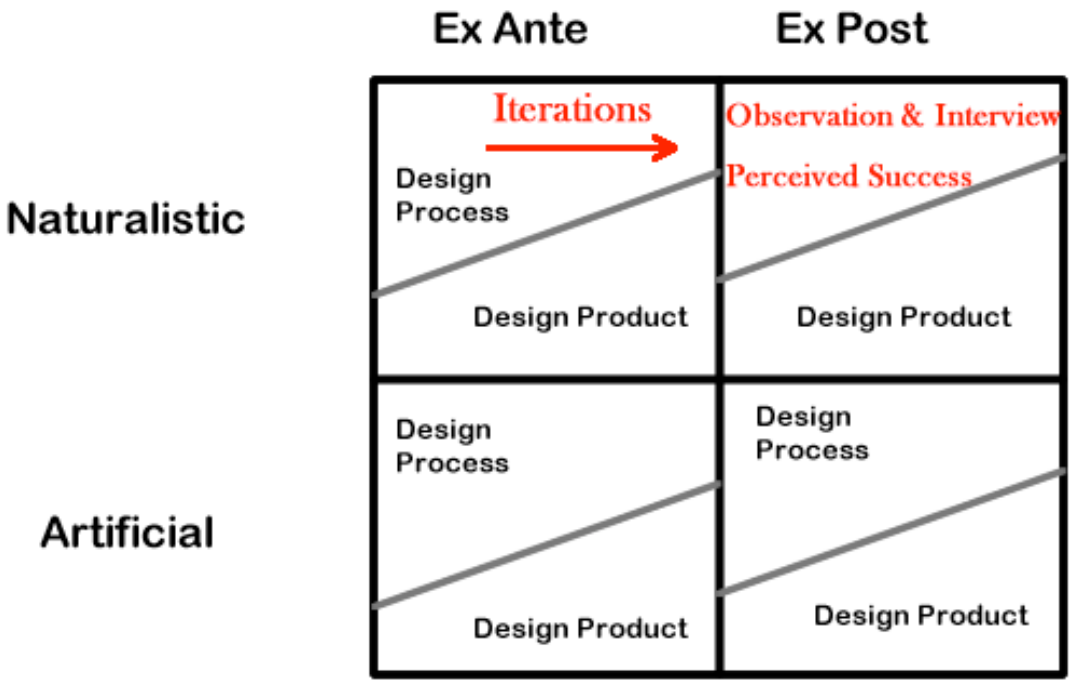


Figure 5.1: DSR Evaluation Framework

(Source: Pries-Heje et al., 2010)

There are two main dimensions in this framework: time and evaluation method (Figure 5.1). Firstly, the framework asks some very important questions (Pries-Heje et al., 2010).

- *What* is actually evaluated?
- *How is* it evaluated?
- *When* was it evaluated?
- *Who* is evaluating?

"What" is evaluated may involve choosing between the design process and the design product (Walls et al., 1992). "How" to evaluate may be selected from naturalistic or artificial forms of evaluation (Venable, 2006a). "When" to evaluate may be selected from ex ante, ex post, or both. Ex ante evaluations take place before the system is constructed and ex post

evaluations take place after the system is constructed. “Who” incorporates aspects such as the evaluation context: real users, organizations and problems.

Applying these concepts in DSR can become complicated because the system, as a reference point anchor, may not be relevant. DSR evaluation can instead anchor to the artefact. There are advantages to both artificial evaluation (such as more control and lower cost) and naturalistic evaluation (more realism). Evaluation of artefacts in artificial settings is not limited to experimental settings, but includes somewhat imaginary or simulated settings where the technology (or its representation) can be studied under substantially artificial conditions.

The main questions that Pries-Heje et al.’s (2010) framework propose can be answered in the following way in relation to this study:

• *What* is actually evaluated? For this study, both the process and the final product were evaluated. As Pries-Heje et al. (2010) describes, a well-described and sound process yields a better chance of producing an artefact.

• *How is* it evaluated? Evaluation using case study is a naturalistic approach. The new design process was used to design the website of an SME, the outcome was evaluated by a group of users, and expert designers were also interviewed to ask their views about the design process.

• *When* was it evaluated? The artefact was evaluated ex post (after the

design artefact was developed).

• *Who* is evaluating? Users and designers evaluated the artefact.

5.2. Methods Used for Evaluating the Artefact

To evaluate design artefacts that are processes, we can draw from work on process-based quality. Several authors (e.g. Walls et al., 1992) have distinguished between design artefacts that are products (e.g. a new IT system) and processes (e.g. a method for developing an instance of the new type of IT system). As Pries-Heje et al. (2010) describe, the main idea in process-based quality is that a good process will lead to a good product. A process can be defined as the set of activities, tools, methods and practices that can be used to guide the flow of production (Humphreys et al., 2008).

The methods chosen in this study are based on Isbister (2006). He used Emo cards, open-ended testing, and a sensual evaluation instrument using patterns to evaluate the interface. Similarly, multiple methods were used in this study to triangulate the evaluation of the design process.

Table 5.2: Evaluation Methods Used in This Study

Evaluation Method	Artefact	Goal of Evaluation
User Task Analysis	Product (Website)	To test the usability and functionality.
In-Depth Interview	Product (Website)	To whether users were satisfied with the integration of their needs.
Expert Review Analysis 1.Survey 2.Interview	Design Process (Artefact)	To compare existing design process with the new design process on the various dimensions (social, cultural, psychological and cognitive needs).

As Table 5.2 and Figure 5.2 show, the artefact was evaluated using three methods. Multiple methods provide an opportunity for rigorous evaluation and effective feedback.

Firstly, user task analysis was used to evaluate the usability of the website. Wright & Monk (1998) suggest that testing using the think aloud method is not only an effective evaluation technique for designers, but also provides significant gains to designers carrying out their own evaluations. User task analysis is an effective tool for evaluating usability of the interface (Ahmed et al, 2006; Al-Qaimari, 2007; Hackos & Redish, 1998; Nielsen, 1993; Wright & Monk, 1998).

Secondly, in-depth interviews with users based on multidisciplinary principles (Brown, 1999; Shneiderman, 1998) were used to assess whether the needs of the users were integrated in the website. Researchers have used in-depth interviews when working with multidisciplinary principles (Al-Qaimari, 2007; Chang, 2006; Nesbitt, 2005a,b).

Thirdly, the process was evaluated by a group of experts. They were asked to compare the new process with the older processes on various dimensions. Studies have shown that design feedback provided by experts is valid and useful (Cuomo & Bowen, 2003; Desurvure, Kondziela, & Atwood, 1992; Doubleday, Ryan, Springett, & Sutcliffe, 1997; Jeffries et al., 1991; Peng, Ramaiah, & Foo, 2004).

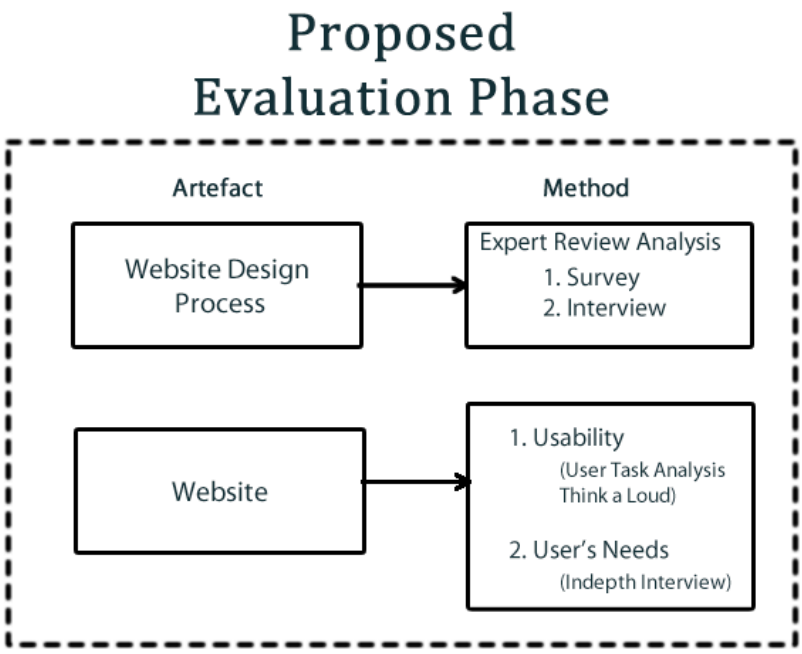


Figure 5.2: Evaluation Process Used in This Research Study

5.3. User Task Analysis – Think Aloud

User task analysis can help us to see how users interact with the interface, and ensure efficient and effective website design. User task analysis provides a complete description of tasks, sub-tasks, and the methods required to use an interface in order to perform tasks (Wright & Monk, 1998).

In Wright and Monk's (1998) think aloud method, users are told to think of themselves as co-evaluators of the system. They were occasionally asked questions such as *What will the system do if the image is slow to appear?, Why did you click on this button?* When the user asks questions about what to do next, for example, the evaluator asks further questions about the operations available, their interpretation of the screen, and so on. The

closer the match between user task analysis and actual end-user tasks, the better and more effective the final user interaction design.

Six participants were randomly selected from a sample of students and parents for this evaluation phase. The participants were a new group of users and not the same group who participated in the design process. Participants were encouraged to say out loud the information that they were processing while performing the tasks. All of the participants were naïve users and not designers or psychologists. They were asked to perform five tasks on the website.

Prompting and echoing was used to encourage participants to think out loud. From user task analysis, we can also obtain some impression of the severity of problems for a particular participant or the level of satisfaction for someone who had a positive experience.

The tasks were selected based on the expectations of what the website users (athletes, coaches and parents) would require from the site.

Each participant was asked to perform these tasks:

Task 1 (T1): Find athletes who play tennis.

Task 2 (T2): Find out if the organization guarantees the scholarship.

Task 3 (T3): Find the video of a selected player.

Task 4 (T4): Find some information for parents who wish to enrol their children.

Task 5 (T5): Find a detailed brochure about various packages.

5.3.1. Results

Table 5.3 shows the results of the user task analysis and the communication during the process of performing the tasks.

Table 5.3: Results of User Task Analysis

Themes	Comments
Psychological	***Researcher:****"How did u think that you should click on athlete?"* **U1:** "It just seems that it will take me to a group of athletes and then few pictures and those are telling me that they are tennis player or not". ***Researcher:****"Does this make you feel good?"* **U1:** "Yaaa but I wish it would say that if you click it will take you to YouTube video otherwise I though sponsors or whatever". ***Researcher:****"So that is the first place you think they will have information for parents?"* **U1:** "Yaa About us, it seems a right kind of place to have it. Not here, ok I go to home; I suppose this would be here. Not here". ***Researcher:****"How does this make you feel?".* **U1:"**Seems alright but I suppose there needs to be more information. I work visually so I prefer images".
	Researcher:*" So where will you go first"?* **U2:** "Maybe in the Athletes…ok no there. Then I will search. Tennis…home…I will go

	back home". ***Researcher:*** "*Why did u go back home?"* **U2:** "I thought I can search from profiles then from there people who play tennis,…. Sports I am guessing, So I can click on there of profiles, so play tennis…" ***Researcher:*** *"So as a user where do you go first to find something"?* **U2:** "I go to home". **U2:** "I go to scholarship opportunities". ***Researcher:***"*Do you expect it to be there"?* U2: "Yes…Not here. So I will go home".
	Researcher:"*Why do you think it should be on home"?* **U3:** *"*Normally when I go to any site there is always random thing showing and there is a play button. No it is not here. May be under athlete. Maybe I click on the athlete I can see the video". **U3:** "I am guessing about us section so that parents can find information. That is the first place I will go". **U3:** "Ok not blog..not about us…I am trying to think in my mind where I should click". ***Researcher:***"*So what is your thinking process"?* **U3:** "The heading or the sub titles should give

	us a clue what's inside the sections, so maybe if you go home you can get some information. Look there should a thing for parents as well. So I found it, but Is there a brochure? It just says packages but it doesn't say any downloadable brochures. I feel a bit challenged. There is lot going on with sub heading".
	U4: "I would probably look in the contact us". ***Researcher:*** "*Why do you think so"?* **U4:** "Because most sites with contact us has information for parents and may have some brochure. I also use search bar and that errors out". ***Researcher:*** "*Will you ever go to home page"?* **U4:** "I normally continue and never think of going home. I will also go to FAQ's. I would go down to packages offered. There is a video and I have to scroll down the page and the brochure should be at the top".
	Researcher: "*So where will you go first"?* **U5:** "I probably click on the athletes' tab". ***Researcher:*** "*Why do you go there"?* **U5:** "That is the obvious thing to do. I think

	the function here where you can select the sports". **U5:** "I would probably go back home, as it is another important thing. Here it is. Home is the place where all-important thing is where everyone goes. I liked the drop down boxes with different categories".
	Researcher: "*Where do you think it might be"?* **U6:** "I am not too sure. It maybe in the blog section…maybe go to the athletes. So they have each got one. Regarding video, should they have different sections or you are fine with this. Maybe they need to have a bit of description about the athlete. It is a common sense that you expect a video". ***Researcher:*** "*Where do you go first"?* **U6:** "I will go to about us; this is where they will have all information about them"'.
Cognitive	***Researcher:*** *"Can you use that search?"* **U1:** "Yes I am just typing tennis player. And it comes up with two and it has a little bit of information and there is an image. I am trying to click on it but I can't. It is lame. As a visual person, if it was a button that would be cool. But it is quiet clear how it has all the information. They have laid information well". ***Researcher:****"So you are using a search option?"* Ya.. **U1:**"Can't read what they say but there is

	something". ***Researcher:*** *"What did you expect there?"* **U1:** "With the scholarship page I expected how you can get a scholarship or previously people got a scholarship. ***Researcher:*** *"So that is where you thought you can find a video?"* **U1:** "Emm because it is athlete information page. It doesn't have enough options to see more information and ya this person have a video. They have you tube link, if I just click, yaa there is a video as well". ***Researcher:*** *"So that is the first place you think they will have information for parents?"* **U1:** "Yaa About us, it seems a right kind of place to have it. Not here, ok I go to home; I suppose this would be here. Not here". ***Researcher:*** "*Do you think most of the users work visually?"* **U1:** "No not at all".
	Researcher: "So will you get through each profile"? **U2:** "Yes I think so unless I have better options. So what you feel here, do you feel challenged? Yes I do because I cannot find easily". **Researcher:** "What you are trying to do"? **U2:** "Trying to find…It is so confusing…"

	Researcher: "How do you feel mentally, like do you feel settled seeing the sections"? **U2:** "I feel better because they have got proper title instead of finding. And that is the brochure". **Researcher:** "Usually where do you find a video of person"? **U2:** "So maybe back in the profile of the athlete. I will go to the profile". ***Researcher:*** "*What do you feel because you jumped from different sections"?* **U2:** "That is my nature".
	Researcher: "*Where do you go first if you want to find about the scholarship"?* **U3:** "Ohh I shouldn't have gone there, I will go to scholarship oh. there we go.. So I am going back to home I am not sure if I go to their name. I am finding about them.. I will go to scholarship opportunities. There is nothing else mentioned. I will go to about us and see what information they have about us". ***Researcher:*** "*Do you like this process? The way they have organised"?* **U3:** "No". ***Researcher:*** "*So what do you prefer"?* **U3:** "I prefer to be easy. Good on home they have everything".

	Researcher: "*Did u feel it challenged"?* **U3:** "No not but it was average". ***Researcher:*** "*Where else you can think of"?* **U3:** "Maybe be try contact us. I never though us it will be here. I definitely thought it would be in about us as it is about them". ***Researcher:*** "*Is it not linked properly"?* **U3:** "Yes it is not clear".
	U3: "No". ***Researcher:*** "*So what do you prefer"?* **U3:** "I prefer to be easy. Good on home they have everything". ***Researcher:*** "*Did u feel it challenged"?* **U3:** "No not but it was average". ***Researcher:*** "*Where else you can think of"?* **U3:** "Maybe be try contact us. I never though us it will be here. I definitely thought it would be in about us as it is about them". ***Researcher:*** "*Is it not linked properly"?* **U3:** "Yes it is not clear".
	U4: "Site is a bit too animated for my liking; I don't like too much animation. I will look under athletes because that is the tab heading that I am looking for, then I will look for and that is sort for played sports. That should be all". ***Researcher:*** "*Was it easy to find"?* **U4:** "I was easy for me. Search is good but I

	don't like typing". **Researcher:** "So as a user you like drop-down menu"? **U4:** "Ya… it should automatically go there". ***Researcher:*** "*So where will you go first"?* **U4:** "I think there will be something in FAQ's. Maybe guidelines to see what requirements you need. I would try to look in the search bar but not sure it does anything good. I cannot read the results. Maybe nice if there is some thumbnails because the basic information is too vague. I would have given up". ***Researcher:*** "*What are your feelings"?* **U4:** "I feel they have spent too much time on looks rather than thinking how user will navigate".
	U5: "I will go to about us". ***Researcher:*** "That is where you think it is"? **U5:** "Ya because that where it tells me gives me all information about them". ***Researcher:*** "*It is not here, so how do you feel"?* **U5:** "Maybe if this was on about us then it is good. For me contact us are the place where I write a question or finding the information".

	U6: "I will go to athletes and who play tennis". ***Researcher:*** *"Do you ever click on the button or do you think it should drop down"?* **U6:** "I didn't notice this drop and go button. I though this is part of some category. Maybe they should make it more obvious". **U6:** "I will go to scholarship opportunities". ***Researcher:*** "*Was it obvious"?* **U6:** "I was looking through the words scholarship and I will scan and see if it has any information. Ya that is where you have". **U6:** "From home, I will go to the packages offered. I concentrate more on the drop down menu and relate with the search. For me it is always looking for the key words to find information. For me it is always scanning, I don't read the information, I just relate to the words".
Emotional and Trust	***Researcher:****"So what made you to go home"?* **U1:** "I don't know I just thought that it should be a different section although it would have been better to just stick with athlete and see in the bottom to see if they have got scholarship or not". ***Researcher:****"What do you feel now?"* **U1:**"A bit sad".
	Researcher: "How do you feel mentally, like do you feel settled seeing the sections"?

	U2: "I feel better because they have got proper title instead of finding. And that is the brochure". ***Researcher:*** "*So what do you prefer"?* ***U2:*** "I prefer the navigation to be easy. Prefer to go home as they have everything there".
	Researcher: "*Why do you go to athlete"?* **U3:** "Because it is the first thing there and the name says athlete so guessing it is there". ***Researcher:*** "*Is that what you normally do"?* **U3:** "So connect with the word that is shown to the task I am asked. Ok I found it". ***Researcher:*** "*How do you feel about the process?"* **U3:** ***"***As a user I will straight away go to the scholarship opportunities section".
	U4: "I go back to athlete and looking to the information". ***Researcher:*** "*Is that the place you find the video"?* **U4:** "I also think in blog sections or sometimes you have video feed or you tube channel". ***Researcher:*** "*Why do you think of YouTube and Facebook"?* **U4:** "You tube is the most popular domain and I spend a lot of time on YouTube". **U4:** "I would normally look into about us". ***Researcher:*** "*Why do you think so"?*

	U4: "I assume other people may also need this information apart from parents. So when it says about us we just assume there will be every part of information we need. It may also have links about the information. I cannot find anything". *Researcher:"So how do you feel"?* **U4:** "It is in contact page that doesn't make sense. Few images are like comic page".
	U5: "I would go to home probably because it is important". ***Researcher:*** "*So usually you go home"?* **U5:** "Mostly, here we go. That is what you expected". ***Researcher:*** "*Do you find comfortable using it"?* **U5:** "I think it is a normal thing to use this website. I would go to athlete again. Here it is". ***Researcher:*** "*How do feel that you got it"?* **U5:** "Feel confident that when I selected a profile the video came up". ***Researcher:*** "*It is not here, so how do you feel"?* **U5:** "Maybe if this was on about us then it is good. For me contact us are the place where I write a question or finding the information".
	Researcher: "*Why you though like that"?* **U6:** "Maybe it is just I am not 100% sure

	about the whole site in general. It is in Contact us section. For me contact us are where I can find a form or an email. This is not the place I think of downloading information".

5.3.2. Discussion

The results were transcribed and coded using NVivo and are grouped below in categories. By detecting themes and pattern matching, the results were grouped into psychological, emotional and cognitive needs in NVivo. There were no comments related to the users' social needs. The results highlight the importance of graphic design, psychological, human behaviour, and emotional issues in the design process and provide some interesting information which designers usually overlook when designing an interface for a website.

Table 5.4: Time Taken by Each User to Complete All of the Tasks

User	Time Taken by Users
User 1	7.38
User 2	5.19
User 3	10.52
User 4	9.11
User 5	5.09
User 6	6.50

Table 5.4 shows the time taken by the user varies as each user processes and reacts to the interface differently. The coordination between mental process and the motor action is different for each. It takes time to process the information and react online. This study shows that if users do not feel comfortable at the initial stage, then they hesitate and feel uncomfortable using the website. This is important because loyalty, satisfaction and confidence towards the website is built at the early stage of the usage (Zviran, Glezer, & Avni, 2005).

The results were grouped into themes based on the multidisciplinary design principles of Brown (1999) and Shneiderman (1998) who identified various needs of users such as psychological, cognitive, social, personal, and emotional.

- *Psychological Analysis*

The psychological needs of the users include human responses when they interact with the design, such as trust, perception and emotional reaction towards the website. Psychological aspects play an important role in building loyalty with users.

The findings of this study show how users react and how they are behave when they seek online information. Users usually relate what they encounter to what they have seen and assume that their past experiences are the norm for all online information. As a user, they are conditioned when using websites based on our past experience of using websites, norms of websites or general online behaviour (Oulasvirta & Saariluoma,

2004). For instance, they might try to click on an image assuming that is a video or a hyper link. In our study, 90% of the participants tried to click on an image, assuming it was a button. Understanding how the user is going to interact and designing the website accordingly is a crucial aspect of the design process (Saariluoma et al., 2009). Easy-to-use websites enable users to input very little, but the output for users may come in abundance. Such a gratification experience is also consistent with Wolf's (1999) observation that nowadays people have limited time so if they invest time in entertainment, they tend to demand more intense, more concentrated, and more satisfying returns.

Users respond faster when graphics are used compared to text. One of the users responded: *"Seems alright but I suppose there needs to be more information. I work visually so I prefer images."* In this study users preferred images rather than reading the information and clicking on "more info". As Shedroff (1999) mentions, the disciplines that communicate through senses are more creative in establishing connectivity with their users. It is much easier to communicate with users visually. Graphics allow users to compensate for missing cues in text using images, sounds and other interactive elements (Shao, 2009).

- ***Cognitive Analysis***

According to Spivey (2007), designing information formats in such a way that the human mind can process the content more effectively is an

important principle of information design. Cognitive skills include language, memory, perception, learning, and attention.

This study found that most users tried to connect with the headings of the sections and links to the relevant information they were searching. Not many users read all the information on the website. They scanned or glanced at the information provided on the website and tried to relate to the words. Using interactive elements is more effective than using text. It also leads to creating a positive attitude among users. Research on uses and gratifications suggests that user-friendly interaction elements are more likely to engage in the human-to-human interaction that leads to a positive attitude towards the brand or the organization (Ko, Chang-Hoan, & Roberts, 2005).

> ***Researcher**: "How do you feel mentally, do you feel settled seeing the sections?"*
>
> ***User**: "I feel better because they have proper title instead of having to search."*

Users feel settled when they find what they are looking for on the website. It is important to understand how the dynamics of the human mind work in processing information (Spivey, 2007). As a designer, it is important to understand what you are trying to communicate. In this study, we found that users did not like getting distracted by the animations when they were trying to process mentally and correlate hand movements. It is difficult for users to perform multiple things on the screen. When a user is

trying to read the information at the same time, they cannot concentrate on the animation. They feel it is a distraction that draws them away from the primary purpose. As one of the users stated, *"Site is a bit too animated for my liking; I don't like too much animation."*

The uses and gratifications theory posits that when e-business employs techniques that are too flashy with large graphics or abuses those techniques by tracking consumer information and behaviour online, web users may perceive this as an unwanted, offensive, and negative influence (Suh et al., 2010).

Most users jump between sections when using websites: if they cannot find the information in a short span of time, they feel challenged and navigate from one section to another section looking for the information they want.

- ***Emotional and Trust Analysis***

Trust is both an emotional and logical act. Emotionally, it is where you expose your vulnerabilities to people, believing they will not take advantage of your openness. It has been suggested that the design of the human–computer interaction has an influence on the level of trust among potential customers (Egger, 2001; Kim et al., 2008; Nielsen, 1993; Norman, 2002). This study found that users felt emotionally connected to the website because of its interactive elements. Users interact with each other through email, instant messages, chat rooms, message boards, and other internet venues. Such interaction can be considered either an

indirect or direct way for individuals to fulfil their social interaction needs (Chan, 2006).

The findings of this study indicate that websites need to be strategically designed to address users' concerns. To build a feeling of trust and confidence among users, creating a "home" section to go back when they feel insecure or lost is very important. This creates a vital centre point that leads to all the sections of the page.

> ***Researcher:*** "*So what do you prefer?"*
>
> ***User:*** *"I prefer the navigation to be easy. Prefer to go home as they have everything there."*

Going back to the home page makes the user feel safe and secure and provides reassurance that they are in the right place. In our test, all of the users preferred to go to the home page when they could not find what they were looking for. Going "home" was instinctive among users. One of the users said, "*I would go home probably because it is an important place to find all the information.*" The layout of the information and the overall design made users feel assured and confident using the website. As a designer, it is important to understand what task users currently perform and how it makes them feel (Nielsen, 1993).

Users felt emotional satisfaction when they saw personal videos and blogs. Users created the content of these sections and this provides a feeling of expressing themselves to others. The uses and gratifications theory posits that emotional and social needs are interlinked. Using blogging, video casting, and other presentation activities allows the significance of who

one is and what one does to show. This creates a feeling of self-expression and self-actualization among users and fulfils social needs (Shao, 2009).

5.3.3. Summary

The user task analysis revealed that the website met the users' functionality and usability needs. Users could access the content of the website and navigate easily. Most users were satisfied with the usability criteria such as accessibility, navigation, consistency in design and attractiveness of the website (Nielsen, 1993). The results indicate that the new design process effectively meets the usability and functionality requirements of a website.

5.4. In-depth Interviews

The final interview of participants in rounds one and two of the design process provided an opportunity to collect feedback from them to see if they perceived any improvements in the final interface design based on their comments in the second round. The interview protocol from Chapter 4 was used for this interview process. The data was transcribed and NVivo used for pattern matching. The transcribed data is included in Appendix A.4.

5.4.1. Summary of Interviews

These were the major findings:

- Users are more comfortable with a stylish look, and feel confident when the navigation is user-friendly.

- Users feel safe when one or more options are provided to find about their location when lost. Search options, breadcrumbs or drop-down menus are helpful.
- The interface needs to provide information and testimonials about the organization so that users feel assured about its credibility and find the website trustworthy.
- Users prefer it when blog posts/comments or chat rooms are not moderated because it feels more genuine.
- Testimonials reassure them about the information provided.
- The interface was perceived as being well designed by users from the two target markets (teenage students and parents) because it incorporated videos and links to Facebook, YouTube and Twitter. The parents believed that it looked reputable and established. This is important because the interface needs to relate to the target audience.
- With comprehensive information and players' profiles, the website appeared legitimate.
- Images that are part of the information need to be hyper-linked, because users have a habit of clicking images, instead of reading the text to learn about other navigation options.
- Users need information about the organization or the group of people forming the organization to make the interface more personalized. This provides an added layer of credibility.

5.4.2. Discussion

The feedback about the website's usability was very positive, and the acceptance level of the website was high. In the round two interviews, information about the psychological, social, personal and cognitive needs that users have while using a website was gathered. This provided an opportunity for designers to integrate these needs into the new design. The users became part of the design process; they felt that trust, safety, confidence, reassurance and their personal values had been integrated in the final design.

The users felt safe and confident when one or more options were provided to navigate. It created a feeling of trust and security and they had no fear of becoming lost in the website. Providing information about the organization and the individuals involved in the organization created a feeling of personal bonding with the website. This made users feel assured about the organization and trust the website's content.

Personal information on the website made it look more personalized and added a layer of credibility. The stylish look of the website enhanced the organization's social status with the impression of high business standards. Providing testimonials and a blog that were not moderated made users feel genuine and gave them a sense of belonging. As the website incorporated YouTube, Facebook and Twitter, users got a sense of connectivity with the target market and felt that the organization was establishing social bonding with the users. Previous research suggests that providing higher entertainment value is likely to lead to an

advantage for media users and to motivate them to use the media more often (Suh et al., 2010).

5.4.3. Summary

Overall, users who participated in the design process could see the improvements in the website from the first round of interviews to the final design of the website. The website was able to create trust and create a positive perception about the organization. Users felt a sense of belonging towards the website as they saw that their views were integrated in the final layout.

5.5. Expert Review Analysis

Expert reviews are used by researchers to evaluate system interfaces. Expert reviews are popular because they are much quicker and cheaper to carry out than usability tests. Expert review analysis was used to compare existing design processes with the new design process developed in this study. The expert review was conducted using two methods: survey and interview. Surveys are cost-effective, less time consuming and have higher response quality while interviews provide more detailed information than what is available through surveys. Combining both methods provides an in-depth understanding of the experts' views.

5.5.1. Survey Method

Ten expert designers were selected from the software design, website design, and academic design fields. The snowball sampling method was used to select the experts.

Table 5.5: Descriptive Summary of the Experts

Characteristics	Description
Years of Design Experience	Eight designers had more than 10 years of experience in design industry and the other two had more than 4 years' experience.
Industry Represented	Software designing, web designing, print designing, telecommunication, university design school and system design.
Designers Professional Represented	Senior web designer- university researcher (2), senior Software designer (3), Senior print designer (2), Senior system designer- telecommunication industry (1) and freelance web designer (2).

Table 5.5. shows that the expert designers had valuable experience of designing in their own field. The theory behind selecting multiple evaluators is that a single evaluator could miss many problems while a number of different evaluators will potentially find different problems. Thus, better results can be obtained by combining the results from several evaluators. Nielsen (1993) recommended using "double" usability experts who are specialists in both usability engineering and the user interface to be evaluated to ensure optimal results. A number of studies have showed that the design feedback provided by expert review evaluation is valid and useful (Cuomo & Bowen, 2003; Desurvure et al., 1992; Doubleday et al., 1997; Jeffries et al., 1991; Peng et al., 2004).

The experts were asked to compare the existing design processes (participatory design, usability design, iterative design, and user-centred design [UCD]) and the new design process (Multidisciplinary Design

Process). An evaluation matrix was used to collect the feedback from the experts. This was based on the criteria provided by researchers for evaluating human-centred design: cognitive (Johnson et al., 2005; Spillers, 2001), psychological (Kramer et al., 2000), emotional (Roy et al., 2001; Spillers, 2001), usability (Nielsen, 1993; Norman, 2002; Preece, 1994), and information design (Jacko, 2007; Shedroff, 1999). Prior to the evaluation, a short explanation about various design processes was provided to the experts (see Appendix A.5). The data was collected using an evaluation matrix of 10 experts and the Likert scale was utilized. The scale ranged from 1 to 5 signifying levels of agreement and disagreement with the statements in a questionnaire. 1 means strongly disagree and 5 strongly agree. The main objective of the evaluation matrix is to investigate the advantages and differences of the new design process in comparison with the existing design processes.

5.5.1.1. Results and Discussion

The scores in the Table 5.6 are the mean values for each criterion based on answers from the 10 experts.

Table 5.6: Results of the Expert Review Analysis

Criteria Numbers	Evaluation Criteria Does the process...	Usability Design Process (Nielsen, 1993)	Iterative Design Model (Lowe & Eklund, 2002)	User Based Design Process (Abels et al., 1998)	Participatory Design Methodology (Spinuzzi, 2005)	Multidisciplinary Design Process

C1	Involve users from the initial stage?	4.4	2.8	4.8	4.4	4.4
C2	Collect data on needs & expectations of users?	4.0	3.2	4.6	4.6	4.8
C3	Use early prototyping?	4.2	3.6	4.2	4.4	5.0
C4	Analyse users Language, intelligent etc (cognitive requirements)?	3.4	3.2	4.0	3.6	5.0
C5	Understand users feeling, trust, bonding etc (emotional needs)?	3.2	2.8	3.6	3.8	5.0
C6	Continuously perform iteration of design solutions?	4.0	3.8	4.2	4.4	5.0
C7	Analyse users' Thinking, visual communication etc (mental models)?	3.8	3.2	3.8	3.6	5.0
C8	Understand users social and cultural values, behaviour etc (social needs)?	3.6	2.8	3.6	3.8	5.0
C9	Assess users short-term memory, use of devices etc (physical limitations)?	3.6	3.0	3.6	3.4	4.6
C10	Include multidisciplinary aspects in design?	3.6	3.0	3.4	3.8	5.0
C11	Evaluate using usability performance task?	4.6	3.2	4.2	4.2	5.0

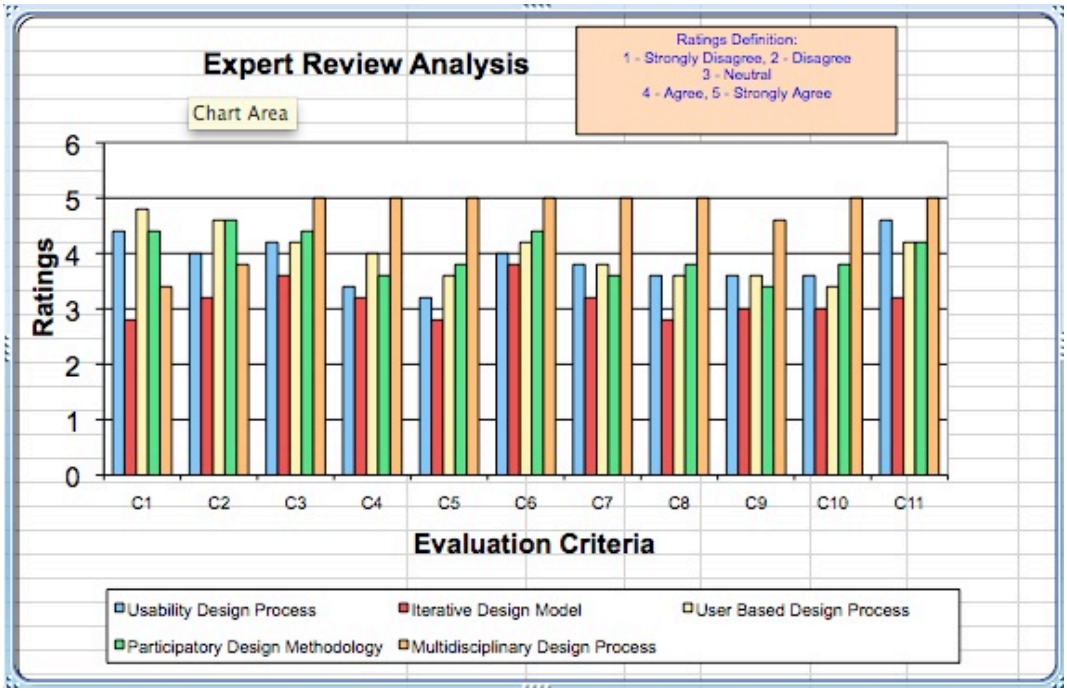


Figure 5.3: Results of the Expert Review Analysis

The results show that the various website design processes are varied in their approach and how they integrate users in the design process. The usability (Nielsen, 1993), UCD (Abels et al., 1998), and participatory design processes (Spinuzzi, 2005) involve users in the initial stage of the design process to identify their needs, goals and objectives. The experts felt that the iterative design model (Lowe & Eklund, 2002) was more client-focused and did not involve users in the design process. Most of the experts preferred to see a combination of the UCD model (Abels et al., 1998) and the participatory design process (Spinuzzi, 2005) which explores the goals and objectives of users, as well as the needs of clients and website developers. The experts agreed that the cognitive, psychological, emotional and social needs of users are important for effective design and felt that not many design processes integrate them well. The UCD and

participatory design processes include them to some extent but not completely.

The experts strongly agreed that the Multidisciplinary Design Process integrated all the needs of users in its two design phases. The experts agreed that the usability design process (Nielsen, 1993) integrates the usability aspects of design in its process and evaluation, which is important in the design process, but does not analyse other user needs in depth. The experts were not sure if the participatory design UCD, usability and iterative design processes assessed users' psychological, emotional and sociological needs as they are not clearly laid out in those design processes.

5.5.2. Interview Method

The experts who participated in the survey were also interviewed to obtain further insights. We conducted a 20 to 35 minute long interview with each expert. These were a series of semi-structured interviews that aimed at investigating the advantages and differences of the new design process in comparison with the existing design processes. Prior to the interview, a short explanation about the new design process and the interview protocol used in the design process was provided (see Appendix A.6).

5.5.2.1. Results and Discussion

All of the design processes begin the same but differ after the initial involvement of user because they do not assess and integrate broader

needs of users. The Multidisciplinary Design Process has two rounds that clearly indicate its purpose: the first round integrates usability and client needs and second the other needs of users.

> *"The difference between these is, the beginning phase is very similar to participatory and user based design but they missed this step and went straight into evaluation step. Let's go design a site and do evaluation."*
> *(Software Designer)*

The experts were pleased that in the Multidisciplinary Design Process the design was created in phases and not in a single round, so if a problem or issue was not addressed in the first round, it could be covered in the second round. They felt that the Multidisciplinary Design Process was very intensive and that there were not many opportunities for the designer to redo the design or fix problems at a later stage after implementation. The evaluation process was rigorous and evaluated in few different ways, which is normally not the case. The expert review acknowledged that a practitioner may have a different viewpoint than a user or a client, which is valuable and experience-based.

The experts strongly agreed that the Multidisciplinary Design Process integrates all the needs of users, and that it was very important to make users feel part of the website.

> *"I think it is very important to know their other needs because unless the users feel part of website or feeling of belongingness user will not use the site. It is very important that user feels a part of the website and not just the user of the website. They think they are getting the importance in the design and every user has different way of looking at the site." (Graphic Designer)*

A few experts viewed the Multidisciplinary Design Process as time-consuming and costly. Other experts noted that the steps are clearly laid out so that the entire process can be shown to the client for their approval. The experts suggested that large companies and not just SMEs could implement the Multidisciplinary Design Process.

> *"Well if it is staged process with very clear steps laid out like you have got here, it makes a lot easier to follow a system. There is no system; there is no clear process that we designers use. If there is a laid out system which we follow then we can sit down with our client and say this is how we are going to do it, these are the steps we are going to do together and this makes a lot easier." (Freelance Web Designer)*

The experts viewed the Multidisciplinary Design Process as a complete process in itsself, from design phase to the final evaluation phase. The process allows a designer to look at both the users' and clients' needs in a less complicated way with clear design phases.

> *"Comparing multidisciplinary process with others, I think it is a complete process in its own which allows you to look at the needs of both client and users. It is very important from the design process that both the users and the clients are looked at rather than focusing only on client or the user." (Academic Designer)*

5.5.3. Summary

Overall, the results of evaluation show that the Multidisciplinary Design Process integrates usability and the broader needs of the users. The process allows a designer to look at both the users' and clients' needs in a less complicated via clear design phases. The new design process is complete and rigorous. It integrates all the needs of users in its two

phases of design and involves users and makes them feel part of the website. The new process could also be used for designing large organizations' websites. The new process can be costly and time-consuming but as the steps are clearly laid out, it is easier for experts to show the entire process to the client and get their approval.

5.6. Conclusion

The new design process was evaluated in this chapter using three methods: user task analysis, in-depth interviews, and expert review analysis. The user task analysis revealed that the new design process integrates the usability principles of the design in the website. Most of the users were satisfied with the usability criteria such as accessibility, navigation, consistency in design, and attractiveness of the website. This shows that the new design process integrates the usability principles in its design process.

The users interviewed felt that the aspects of trust, safety, confidence, reassurance and personal values have been integrated in the final layout. They felt a sense of belonging to the website as they saw that their views were integrated in the final layout. The results of the interviews show that the Multidisciplinary Design Process was able to integrate the broader needs of the users and create a sense of trust and safety.

In the expert review, the experts considered the new design process to be better than the existing design processes. It is complete and rigorous. It

integrates the broader needs of users in the design process. The process allows experts to look at both the users' and clients' needs in a less complicated way with clear design phases.

In conclusion, from the results of evaluation, we can say that the new design process is an improvement on the existing design processes. It integrates the usability and the broader needs of the users in the design process. It was the preferred design process among both users and experts.

Chapter 6

Conclusion

Introduction

This chapter summarizes the thesis, and discusses the contributions it has made towards research and practice, as well as its limitations. The chapter concludes with a discussion of the future directions of research in this domain.

6.1. Motivation for Study

The aim of this study was to improve the website design process for SMEs by embedding users in it so that all of their needs were met. The study was motivated by the difference between the emphasis placed on human-centred design in the wider field of design and the focus on usability that pervaded the field of website design. This distinction meant that website design methodologies had not integrated the broader needs of users, such as their cognitive, social and psychological needs into the design of the websites. Due to the nature of the web application development environment, time schedules for development are relatively short, often being less than one or two months. Therefore traditional methods such as SDLC are not completely suited for web design (French, 2011). Attempts have been made to integrate principles from various disciplines into HCI and SDLC methodologies but they fail to consider the broader aspects of

users' needs. Engineering is still predominantly informed by applied research, and knowing what systems to build and what problems to solve still appears to be the priority within the more technical camps of HCI (Kjeldskov & Paay, 2012). Some progress has been made in integrating the principles of other disciplines and appropriately responding to human emotions and behaviours, but multidisciplinarity is usually absent from the design process.

Modern design is a multidisciplinary discipline that draws on the active involvement of users so as to understand their requirements and needs better. For example, spatial design used the principles of psychology and cognitive theories when designing the space; graphic design uses colour, semiotic and psychology theories to understand the emotional reactions of users; and fashion design uses behavioural theory to understand the behaviour of users. This contrasts with the traditional system-centred approach in the design of IS, where the notion of user value remains largely unexplored (Lamb & Kling, 2003). Using a multidisciplinary approach and encouraging broader and more frequent user participation will increase the effectiveness of a website design process, thereby enhancing the quality of its output, the website. Involving users in the artefact design process is also important to ensure that the outcome is one that they desire, and thus will adopt and use (Humphreys et al., 2008). In HCI and SDLC design methodologies, activities such as planning, analysis, design, coding and testing are performed according to the needs of the customers (Seema & Malhotra, 2012). The same logic applies in the

case of websites: if users are closely involved in the design process, it is more likely that the website will be used by them. Since websites are used by a diverse and often unknown set of users, the challenge is to identify the right mix of individuals who form the target audience and will thus be able to provide relevant feedback.

Developing a structured, user-focused website design process is more important for SMEs than large firms. Although such a process will help firms of all sizes, its development is more important for smaller organizations. Large companies are in a privileged position as they can afford to expend substantial resources, such as time, funds, and manpower, on website design projects. They are also more likely to use the services of established design firms, such as IDEO and Better by Design, or have a team of in-house designers. Both of these options will have clearly defined website design processes. In contrast, SMEs struggle to involve users in the design process because of limited time, budget, knowledge and manpower (Lille, Stappers, & Lugt, 2009). Often, they contract out design projects to freelance designers or small design firms, who may not have enough time and resources to invest in researching the needs of users. They usually rely on an ad hoc design process to design their websites and have a limited time period to do so. The combination of these factors means that the chances of SME websites not meeting their users' needs are high, relative to the websites of large firms.

In any case, even when large firms' websites fail to meet their users' needs, they are able to scrap the project early on or absorb the cost of failure much more easily, because of their substantial resources. They may also have contingency plans if their websites are poorly designed. SMEs, on the other hand, usually have no backup plan if their website is poorly designed because of their limited resources (Lille et al., 2009). Well-designed websites are more important for SMEs because they have fewer opportunities to redo them. Thus, a design process that integrates the needs of users is more important for SMEs when compared to larger organizations.

6.2. Discussion

The thesis used the design science framework (Hevner et al., 2004) to frame the problem and develop a solution. User participation was identified as a suitable approach for involving users' needs in the design process. There are different ways of addressing the multidisciplinary aspects of design. One way of engaging with these principles is by using the uses and gratifications theory, which examines how users actively choose the media they want to use (Blumler & Katz, 1974). Another option for engaging with these principles is using by the HCI design principles of Brown (1999) and Shneiderman (1998). HCI principles are often used particularly when it comes to usability, cultural awareness, the evaluation of web-based systems, interfaces for web / mobile / ubiquitous computing, aesthetics, motivation, social participation, trust, empathy, responsibility, and privacy (Shneiderman, 2007). This study opted to use the latter and

designed a new website design process by focusing on both the usability and multidisciplinary principles of design. After the artefact was designed, it was instantiated in a case study in which it was used by a small design firm to develop a website for a New Zealand-based SME called Play Atlantic. Play Atlantic is an online recruitment agency for students and coaches who want to make a career in sports. Once the website was completed, the artefact was evaluated using multiple methods. The results of the evaluation process confirmed that the artefact was useful and achieved its goals.

The thesis has highlighted many important factors in the design process. The results show that involving users from the initial stage of the design process is important for increasing the effectiveness and acceptance of websites. The evaluation results show that the various needs of users are well integrated in the final design of the website. The user task analysis provided strong evidence of the website's ability to meet its users' functionality and usability requirements, such as accessibility, navigation, and consistency in design. The in-depth interviews showed that users discerned the improvements in the website as it went through multiple rounds of design. Seeing that their views were incorporated in the final design made them feel a sense of belonging with the organization. According to the users, the website portrayed a positive image of Play Atlantic and made them trust it. Finally, the experts who were interviewed about the new process agreed that it was complete and

rigorous, and would make users feel part of the website they helped design.

As a result, the design process built in this research can be implemented by SME designers who mostly work within limited timeframes and budgets. The new design process will provide SMEs with an opportunity to integrate the broader needs of their users in the final outcome. This will result in a website that effectively meets the target market's needs. The proof of the new design process's effectiveness was seen in the final evaluation phase where the users were satisfied with the layout and felt reassured when using the website. This study shows that when the needs of the users are understood and integrated in the design process, the level of acceptance and belonging among users is increased.

6.2. Contributions of the Study

The contributions made throughout this research are diverse, covering theoretical and practical knowledge. The thesis adds value to the research and practice communities, as it is relevant for the design industry, innovation, and the SME sector.

The first contribution of the study is including user participation in the design process. As discussed in Chapter 2, the existing website design methodologies have certain shortcomings. The clients who order the artefact to be built are sometimes not the users who will use it and those who compile the requirements are not the ones who will design the system (Holzinger, 2005; Lamb & Kling, 2003). There is thus a large gap between

those who design the technology and those who actually use it (Berg, 1998). This has been addressed in the new design process by including user participation from the initial stage of the design process.

The second contribution of this study is the integration of the broader needs of users in the design process. Most of the existing design process focuses on the usability aspect of the artefact (Nielsen, 2003) but needs of the users are broader than just the usability aspect. This creates a gap between designers and users leading to an inability to identify or allow for unknown users' needs (Holzinger, 2005). This has been addressed in this study by identifying and integrating the broader needs of users by using the multidisciplinary design principles of Brown (1999) and Shneiderman (1998). To some extent SDLC's agile software development methods are iterative in nature and use multidisciplinary teams but they do not examine other disciplines in the design process (Massey & K.J. Satao, 2012).

The third contribution of this study is its evaluation framework. The existing evaluation frameworks are focused on using usability tests but these restrict designers from obtaining deep insights into user behaviour (Mennecke & Strader, 2002). Users do not necessarily evaluate the complete design, since there is no mechanism to ensure that the entire design is explored (Holzinger, 2005). The evaluation framework proposed in this study evaluates the usability aspects, multidisciplinary needs of users, and opinions of industry experts. The proposed framework is rigorous in evaluating the final artefact.

6.2.1. Contribution to Research

The study integrated concepts from the wider field of design with website design to make the latter a much more holistic activity. Making a website more effective requires the involvement of users from the early stages of the design process and their input on a broader range of aspects of the website. Gregor and Jones (2007) differentiated between different levels of contributions for design science studies and we discuss how this study provided input at all of these levels below.

Level 1: Artefact or situated implementation

The artefact developed in this study is a new website design process. The final artefact extends the focus of existing design processes by integrating the needs of users apart from usability. The artefact was instantiated in the development of a website for an SME, and the evaluation process demonstrated the feasibility of using design principles to develop an artefact to support human-centred design.

Level 2: Design principles

Websites need to integrate the usability aspect of the design and the broader needs of users. Usability has been addressed in website design process by using various usability design process such as Neilsen (1993) and Garrett (2002) but the multidisciplinary needs of the users haven't been addressed in the design process. This creates a gap between designers and users leading to an inability to identify or allow for unknown users' needs (Holzinger, 2005). This has been addressed by

identifying and integrating the broader needs of users by using the multidisciplinary design principles of Brown (1999) and Shneiderman (1998). This study identified and validated a website design process which combined various usability principles (Garrett, 2002; Nielsen, 1993; Norman, 2002) with the principles of multidisciplinary design (Baddeley, 1997; Brown; Dray & Seigel, 2007; Egger, 2001; Endsly et al., 2000). By combining these two principles we are adding multidisciplinary aspects and improving the existing design processes.

This study has extended the existing usability design process and added a new layer of multidisciplinary principles from various disciplines such as psychology and sociology, as well as cognitive theories in the website design process. The latter set of principles is a useful framework for UCD and can be applied by designers of other types of interfaces and media in the IS field.

Level 3: Emergent design theory about embedded phenomena

The goal of design theories in the IS community is to improve the effectiveness and utility of artefacts in the context of solving real-world business problems (Hevner & Chatterjee, 2010).

This study argues that design in the IS field should incorporate an awareness and understanding of a broad range of human needs, and move away from the existing emphasis on usability. IS designers can accomplish this by incorporating multidisciplinary design principles into their design processes. The website design theory developed in this study is an example

of the type of theory that can be developed by the integration of multidisciplinary principles with existing design methodologies. Although this study hasn't come up with a design theory but it provides scope for a new design science theory by integrating the principles of design science and the design theories such as classical and semiotics design theories.

6.2.2. Contribution to Practice

The study makes important contributions for both web designers and SME managers. Websites have become much more complicated and sophisticated, from showing static information to involving sophisticated interactions between users and the database in real time and due to this rapid growth and evolution of the SMEs do not have sufficient funds to develop, evaluate and manage a website in the same way larger companies do (Huang et al., 2010). The complexity of web-based applications in SMEs as well as in big companies has grown significantly, but currently most designers, especially in SMEs, often use ad hoc, hacker-style approaches (Berry, 1992; Lille et al., 2009) and pay little attention to users' needs. Many researchers have raised serious concerns about the design and evaluation of websites (Deshpande et al., 2002; Escott, Strooper, King, & Hayes, 2012; Lille et al., 2009). Normally, the developers do not like to follow any process model, which could be too constrained and time-consuming to apply, plus there is a lack of management to control the development process in SMEs. They tend to hesitate about moving on to a new technology, system or development process due to the unknown costs and perceived risks.

Website designers can use the new website design methodology to enhance the quality of their output, and ensure that their clients are more satisfied. The interview protocol provided here will be a useful tool for assessing the broader needs of users. The process will clarify for them the various needs of users in the design process, providing a deeper understanding of their client firms, which may hopefully lead to greater repeat business in the future. The rigorous evaluation process described here can also improve the effectiveness of their websites, because they will be able to clearly specify which aspects of the design succeeded, as well as increase the acceptance of the website by its users.

SME managers will benefit from an efficient methodology that will help develop more effective and widely accepted websites. As discussed in Chapter 2, the participation of users is more important for SMEs compared to large companies because of their limited resources. The freelance designers or small design firms that are used by SMEs are usually unable to dedicate time for research on users and rely on ad hoc design processes; they will now be able to use the structured process presented here and enhance the quality of their output. Most of the time, designers are under pressure to respond rapidly to design briefs and generate concepts (Carlos & Price, 2012). The proposed design process uses user participation throughout the process. As a result, website failures due to a lack of recognition of users' needs and requirements can be reduced.

The new design process will generate a wealth of ideas that capture the shared knowledge of the user community and reflect their needs more effectively. This will help SMEs because they will not have to invest any additional resources (manpower, money and time) in understanding the needs of their target market. The process will assist SMEs in developing good and authentic relationships with their user community. It will be easier for SMEs to build loyalty and branding among their users as the website will convey the appropriate perception of the company. Websites have a higher rate of acceptance if users are involved in the design and development process (Kujala & Mantyla, 2000).

The results of the evaluation process indicate that the design process can make websites more effective, acceptable, trustworthy, and easy to use, as well as enhance the feeling of belonging among their customers. While the new design process may be time-consuming and expensive initially, it should lead to the success of the business in the long run. It will reduce the redoing of websites and build a strong connectivity with users.

6.2.2.1. Guidelines for Practitioners

The new design process is meant to facilitate designers by integrating the broader needs of users, usability principles and rigorous evaluation methods in the website design process and involves three rounds. Each round is associated with guidelines, good practice and methods for supporting the designers in designing SME websites. The first two rounds involve designing the website using the new design process and the third

round is the evaluation of the website. The new design process integrates the usability principles in round one and the multidisciplinary principles of design in round two. The third round evaluates the website using a triangulated method. The detailed activities involved in three rounds are presented in Table 6.1.

Table 6.1: Detailed Activities Involved in the Design Process

Design Phases	Details
Round One	● Understand the objectives and purpose of the website ● Identifying the target market ● Select users for participation in the design process who represent a good mix of target market ● Understand the needs of the users, mostly around usability and functionality of the website ● Determined how to include the needs by exploring usability and design theories ● Designing the wireframe based on the needs of client and users
Round Two	● Collecting the feedback from the client on the wireframe designed in round one ● Identifying and understanding the broader needs of users using interview protocol ● Integrating the broader needs of users in the interface of the website ● Redesigning the wireframe based on the feedback from client and users
Round Three	● Evaluating the website before it is launched ● Collecting the feedback from users and experts on the website using triangulated evaluation method ● Redesigning the website to accommodate the feedback collected from evaluation process ● Launch of the website

The following guidelines are intended for practitioners when designing SME websites. They have been developed from the new design process, the literature on design theories, and the multidisciplinary design principles used in creating the new design process.

- **Use multiple phases in design**

  It is essential that the design process consists of more than one design phases. This will provide an opportunity to integrate different aspects of design and the broader needs of users. This this study, phase one integrates the usability aspect of the design and phase two integrates the multidisciplinary needs of users such as emotional, psychological, cognitive needs, social and cultural values.

- **Provide a multidisciplinary design team**

  Effective design and development of the website requires very diverse talent in the team. It calls for a balanced team with skills from various areas such as interface design, visual design, usability assessment, and user-centred needs. Understanding the usability needs and requirements of the users is essential. In-depth interviews can be used to understand the needs of users when interacting with the website. Knowledge of design theories from design disciplines such as cognitive, semiotics, graphic design, and pattern-matching is required. These theories will provide guidance to transform the needs and requirements into the visual interface.

- **Choose a range of users**

Selection of users for participation in the design process is crucial. Users needs to be from a broad spectrum of groups and not just employers from the company who commissioned the project. Users need to represent the broader target market of the project.

- **Clarify the multidisciplinary needs of the users**

  Understanding the broader needs of users is crucial to create a feel of belonging and loyalty among users. Using multidisciplinary design principles to understand the emotional, psychological, cognitive and social needs of users helps to understand the needs. This will provide a complete understanding of users and their tasks. In-depth interviews can be used to access the needs of the users. Structure the questions of in-depth interview so that user can understand and respond without confusion.

- **Ensure early and ongoing user involvement**

  Involving the users in requirements determination, designing, and testing from the initial stage provides a direct conduit to the knowledge they possess about the tasks, goals and needs. Involvement in the design process gives the user a stake in or identification with the outcome. It creates a sense of belonging.

- **Use a new set of users for evaluation**

  Designers need to use a new set of users for the evaluation process. This provides feedback from different viewpoints. A new set of users will provide fresh and unbiased opinions about the website as they are

experiencing the website for the first time and were not involved in its designing.

- **Providing tools for interaction**

  Users should be given sufficient opportunity to build dialogue between the fellow users and the organization. A platform for communication and expressing their views and opinions needs to be created. Users feel satisfaction and accomplishment by being part of the community. Offer information and instant feedback by using tools such as blogs and discussion forums.

- **Allow personalization**

  Make the personalization more evident by allowing users to see and change their profiles. The needs of each individual user must be considered when creating profiles. Users are to be valued by making their roles evident and providing complete access to the content.

- **Visual presentation of information**

  Use visual presentation of information and minimize the input of the text. Use images to facilitate learning and ensure images convey intended messages. Limit the use of large images, animation and video on informative sections of the site. Use clickable images as users are used to visual navigation.

- **Providing authentic and updated content**

  Provide information and achievements about the organization. The information needs to be genuine and up to date. It needs to be authentic in order to build the trust and loyalty among users. Display

only necessary information that facilitates scanning. Provide downloadable options for larger content. Format information for multiple audiences and group them accordingly. Provide a simple search option on all the pages.

- **Use multiple evaluation methods and criteria**

  Use rigorous evaluation methods to test the website before it is launched. It is best to use multiple methods as you can then get feedback from more than one source. Multiple methods will provide feedback on different aspects of design such as usability, multidisciplinarity, and opinions from experts who have valuable experience. For expert analysis, select experts from different areas of the design industry such as software designers, systems designers, design consultants and academics.

6.3. Limitations and Future Work

While much research, including the present, provides valuable insight into how to integrate the psychological, social, and other needs of users in the design of software artefacts, much remains to be done. It is hoped that this study has shed some light on how to integrate user needs with the new design process. The factors below may be seen as potentially limiting the study's conclusions and should be considered when evaluating its results.

1. It was a challenge to find a designer and an SME who were willing to participate in the study. Designers were reluctant to expose their

design to users and accept their criticism. Thus, the design firm and client we used to instantiate the new process may not be representative of the majority of SMEs and designers. For example, they may be more open to use participation, more willing to bear costs and to take time in designing. Other firms may be less keen to involve their users and managers in the website design process, preferring the more traditional methodologies.

The generalizability of the new design process can be assessed by instantiating the new process in a wider variety of clients and design firms. A simple extension would be to instantiate the new process in larger firms and with different media (such as e-books, mobile applications, and games) to evaluate its usefulness in a broader context.

2. Besides interviews, users' needs could have been assessed with other methods, such as observation, Emo cards, focus groups, and cognitive walkthroughs. Each method has its own advantages in assessing users' needs. The selection of method depends on the skills of the designer, the time available, and the resources allocated. These can be incorporated into alternative versions of the methodology and their differential value can be compared.

   Alternative data collection methods could be used in future studies which may provide new insights. Another approach would be to survey firms about their website design processes, categorize them

by the breadth with which they captured users' needs, and then relate these to various aspects of the websites, including usability, sense of community, and firm perception.

3. It was a challenge to transform users' needs into a visual format because users perceived the meaning of each type of need differently. One way of overcoming this was to explain to them the meaning of the various needs in simple and clear terms. To some extent, the use of a standard interview protocol may help in this regard.

4. The time allocated for the overall design process was very short. Thus, it was challenging to quickly select an appropriate set of users who would provide authentic feedback and be willing to be involved in the design process. This is because they had to commit to participating in all the three rounds of interviews. There may also have been limited time for the designer to develop the final website.

5. The challenge with a design science study is that no control group exists against which the results of the new process can be compared. In other words, an equally effective website could be created using another design process. While multiple evaluation methods were used to address this shortcoming, it is challenging to conclusively show that the new process is better than existing processes without conducting a very intensive comparison of the

outcomes of instantiations of the different design processes in similar firms with similar designers.

This could be part of a behavioural science approach to answer the research question. A sample of web design firms could be recruited and the type of process that they use could be manipulated so that the extent and significance of its impact could be assessed.

6. The new process may be costly and time-consuming for SMEs, given their common need for urgent outcomes. However, the extra time spent should benefit them in the long run.

7. The effectiveness of the website was not tested after it was deployed. This is an issue because the goals, needs, objectives and values of users will change over time. Thus, a regular review of the website by users' should be carried out to ensure its continued viability.

Some future directions for research were mentioned in the above limitations, such as a comparison of SME websites designed using conventional design processes with those designed using the new design process. The website design theory developed in this study is an example of the type of theory that can be developed by the integration of multidisciplinary principles with existing design methodologies. There is scope for potential theory development by integrating the principles of design science and the design theories such as classical and semiotics design theories. In future, the design process could be used in non-

technological areas such as creating business concepts and designing new business processes using HCI principles. There are possibilities for the evaluation framework to be used to further enable design teams to engage in productive and reasonably scaled user testing that improves the emotional experience for end-users. The evaluation framework is also applicable to processes that are not necessarily technology-based. For example, it can be applied to processes where users are vital parts of the artefact, such as business processes, service innovations, and maturity models.

6.4. Conclusion

The study has argued for the importance of incorporating knowledge from various disciplines when designing human–machine interfaces, especially for smaller organizations that lack resources and are likely to incur a higher negative impact from failed design outcomes. The design process developed and the contributions to research and practice should be seen in the light of the study's limitations. Importantly, the results provide a solid basis for future research to further improve the quality of the interfaces that we interact with daily.

Appendix A

A.1. Heuristic Evaluation Questionnaire

Below are a series of statements about the process of designing websites. Please indicate your agreement or disagreement with the following statements using the scale shown.

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

1	Usability is an important issue when websites are designed.	1	2	3	4	5
2	As a designer, it is valuable to have knowledge of usability and user experience design when designing a website.	1	2	3	4	5
3	Design needs to be consistent with user needs and business objective.	1	2	3	4	5
4	User participation adds value to the design of a website.	1	2	3	4	5
5	Addressing needs of the users at early stage is helpful for designing websites.	1	2	3	4	5
6	In-depth knowledge of user needs plays a major role in designing a website.	1	2	3	4	5
7	Involving users in the design process improves the quality and acceptance of websites.	1	2	3	4	5

8	Website that is designed around the emotional values, reliability, cultural and social values increases the level of user satisfaction and create bonding with the organization.	1	2	3	4	5
9	User involvement makes the website design process lengthy and less effective.	1	2	3	4	5
10	Repetitive test of website design results in a design desired by users.	1	2	3	4	5
11	Evaluating websites with real user is more effective when compared to lab experimentation.	1	2	3	4	5
12	*Which characteristics of users are important for website design:*					
a.	Their psychological aspects (mental challenges, comfort level, personality, simplicity etc.)	1	2	3	4	5
b.	Their emotional aspects (confidence, trust, feelings etc.)	1	2	3	4	5
c.	Their social values (standards, cultural beliefs & values, language used, bonding etc.)	1	2	3	4	5
d.	Their values (likes & dislikes, personal values, opinion, etc.)	1	2	3	4	5
e.	Their physical limitation/ability (memory, vision, etc.)	1	2	3	4	5

A.2. First Round Interview Transcripts

This appendix contains selections from interviews conducted in the first round of the website design process. The first interview is with the client and the second one is with a user. The names have been changed to preserve their confidentiality.

Interview One

Researcher: What image you want to give to your user about yourself, because you don't communicate but website will communicate. So what impression you want to give as a company or an organisation?

Client: So our main, as you can see, our main target market is student athlete, 17 -18 years old. So we are looking at kids who are athletic talented. There are three main sports, soccer, tennis and golf. And good academic good, so score average or above average in high school. If they fill an application and if they pass we re evaluate it or if they pass, then we will sign them up. We will have profile and with that profile we will market that to the college coaches in America and try them to place in the University.

Researcher: So it is more with the students' age group bet 17 to 18 years?

Client: It can be but, at the moment the rules change and it can go up to 24 years – 25. It depends upon which school you enrol.

Researcher: If you are selling this concept who is your main target market

Client: Our main target will be a high school student.

Researcher: So it can be uni students, before Uni Intermediate students

Client: So when last year at school they can go to university or they can go up for university in America. So it is high school leavers.

Client: That is the main market, we are also looking at the college coaches in America where they can also search the students so they would have their own profile page so they search for Jo.. or any students with academic levels. They can sign up.

Researcher: So you have two groups,4 students and coaches, who are quite different and different set of thinking.

Client: You have got the coaches, who are thinking to recruit those students. See you got two parts of the business. So what we are trying to do with Mark is to build the database of a profile page where the students will be able to make the profile. Student has got the profile, show what she has done and we have to market them to college coaches. Coaches will have their own profile. They will be promoted in the University. So that is our main target market, the students who are leaving the high school and the college coaches.

Researcher: So if I am supposed to select an interview process?

Client: I say go for students. You will you have 5 target market?

Researcher: No 5 users

Client: It is definitely students regarding coaches it is more in America.

Researcher: But still a designer you are designing you will need coaches input, you are targeting American market but Mark has to design for that target market as well.

Client: It is not complex, this structure is very simple, it is simple because we know that, you got student athlete, coaches, and we may franchise the business. So they can use our tool to market the coaches. That is another massive section of the business.

Researcher: Agents who promotes the sports. A this stage your primary focus will be students. As the website grows maybe you want to add up the other things.

Client: Definitely.

Client: Another area will be we are looking at graduates as well. I don't want it to complicate but I was doing MBA I was the assistant coach with the tennis team. So we had number of email asking do we have any graduates from a University not from here but an American University, but it can be anywhere. AUT if they had business degree, that is something in the future we can really go off.

Researcher: The thinking will not change much because if you are taking University students they are between 18 – 21 and if u is thinking they are bet 17-18 so there is hardly any age difference or gap. So most of the thinking and the thought and the way they approach things will be same.

Client: I think the best target market will be student's athlete, students are the main targets but it is actually the parents who are the main target as well.

Researcher: Even you should consider the parents as well.

Client: Mostly considering the financial commitment.

Researcher: But in some case they are the decision makers as well

Client: They are 17, are adults, there are not many students who get scholarship; parents will have to be main source of income. Parents should see that their child has enough ability academically and see the sports area.

Researcher: I think in this age group, in this age bracket parents do play a major role, especially in NZ seeing the community and the society we have. They do play a major role.

Client: The amount of stories in University especially in England how the fee has gone up, people are really pushing to America.

Researcher: I will select 5 users with a mix, do you need parents input as well.

Client: ya…

Researcher: Through your website what image you want to project?

Client; It needs to be professional, trust worthy site, not afraid to invest reasonable amount of money in the service. That is the main selling tool, once they see the site, it is our job to sell.

Researcher: So the first point of users' communication or connection will be your site. We have build quiet a good reputation in England or people word of mouth, previous coaches.

Researcher: Is this concept new in NZ?

Client: It is not new, it is have been 1 year. It is worldwide.

Researcher: Do you have anything for reliability?

Client: Some sort of guarantee?

Researcher: Ya

Client: We did have money back guarantee, if we secure the scholarship but not know. We have got testimonials. But it all going to change and we are working hard.

Researcher: So don't have to be licensed or anything? Or there any institute where you can register?

Client: na..

Researcher: Thanks for your valuable time.

Interview Two

Researcher: What do you think a good website is as a user?

User 4: I look initially for general appearance, personally I like it to look professional then as user I want to find information I want really quick, not quickly efficiently.

Researcher: So when you say professional, what do you mean?

User 4: I just find it really off putting, you see website where you have got like a bright or dark blue background an there is yellow type with kind of halos around so that you can't read, big type and you can see and know where to look for things and you might have just few menu bar at the top with some pictures in it. It is just a kind of it doesn't look anyone cared and professional.

Researcher: So it doesn't look that someone has put effort.

User 4: It looks like they have used some kind of template and just stuck some things on, it doesn't look like they rally care, it will be like the equivalent of going to do shopping and it is not supposed to be a warehouse but it basically it is like a warehouse somebody has taken an A4 poster and stuck on the front of the door saying, you know a acme T-shirts co.

Researcher: So they haven't taking an effort to make it visually and make look and feel good.

User 4: That is the first things I haven't got into the website to get the information I want but it is the first impression do count for me. It is an immediate; they look like Mickey Mouse you know. I guess the exception will be some thing with Science, say I was looking for some information say medical or maybe mechanic or something you kind of expect it to be a bit less sophisticated. I kind of give them a bit of licence.

Researcher: That's fine, they have to take an effort to work on look and feel. At least designers should appreciate the needs of the users.

User 4: That's right, they need to feel that because it is not a book I can jump anywhere, it is not a book or a place where I am going. It is really easy for me to jump anywhere else. So I feel like I could go t o somewhere else or back to search and find some more professional.

Researcher: You have seen and used many websites; so seeing the existing websites what you think the designer can do better so that as a user you feel good about using it?

User 4: The first thing is flagging from the homepage or the point at which the link leads to the site. Then say what the organisation is, because I have seen some sites, which go the other end where you know rather use the template they kind of gone off for not using the template at all and done something really crazy and it might be the amazing picture with aaahhh enter or something. I know if you look at the URL and see if I have got the right url but I just wanted to know what it is. I want to know what the organisation is about.

Researcher: should it be up front …

User 4: They may not have a classic homepage but at least a welcome to the site or the name of the site is the bear minimum so that I know that I have got the right place.

Researcher: How do you keep connected with the site? Do you feel this is good site, it really knows what I want?

User 4: I think it would be and I am assuming here that I am searching for information about something that I don't have to go through too many pages or level or clicks to whatever I want. What I would like is something that pretty clearly or efficiently first time you get on to the site allows me to access information I want.

Researcher: So you mean it shouldn't be like a maze.

User 4: No definitely not and maybe well organised categories maybe they though about the contributors or whatever the categories is depending upon the site. So that you can identify yourself as being one of those groups and then you don't have to click through million different options to get to where you want.

Researcher: ya,, true because websites , it is not a book , it is quiet huge so then you need a proper navigation.

User 4: That s right so I guess, speaking as a user, I don't need to be aware of the navigation but at the same time it is a hidden interface it is a hidden thing happening but the same time if I am aware of it or I am having trouble with it I will be totally put off.

Researcher: That's a good thing.

User 4: Ya aya..

Researcher: So instead of googling it will it be useful to put inside the website as these are the reviews etc.

User 4: Probably it would. Because I must admit that …

Researcher: like how trademe has…

User 4: yaa…I know CPIT down in Christchurch when I was looking at the course there, I know they did actually for this particular diploma they did have reviews and had people writing about it Jim from Pukekohe or something writing a little quoted mark, that was something good. But the only problem was that I visited about 6 months later it was the same and I kind of felt a bit not cheated but a bit a like this could have been made up because it was a bit that was added to.

Researcher: So you don't trust whether it is genuine or moderated...

User 4: Ya..kind of. It didn't feel like there were vibrant or actively producing people happy with their services, because there wasn't being updated so Jim could have been there 2.5 years ago and who knows….

Researcher: So maybe one of the point of your trust is it has to be updated.

User 4: yaa. I actually personally like reading other peoples testimonials, if I am interested in the site and keeping up with there service or offer, I don't have to keep reading the same one.

Researcher: Ya..thats true..

User 4: I want to relate to those people like..maybe I don't relate to Jim but there is someone sound like same background as me so therefore they are saying things that can appeal to me. You know…

Researcher: If it like a sports training institute and as a use say you want to enrol to go for further sports training what do you look for?

User 4: Ohhhh…

Researcher: Because you have to invest time, invest money, you have to trust their outcomes.

User 4: Testimonials will be really important also hooks up links with other sports bodies. For example lets say it was my nephew I was giving a present or some and he is really into football, I want to know because he is football mad that this connection say North Shore football club and that kind of approval from other places.

Researcher: Like affiliation

User 4: Affiliation that is the word. That would be really important, testimonials; I think I would also like to think that there is some personal

feedback. Like for eg. There is somewhere a form or something where I could, ask a question and get personal feedback. Will be quiet good.

Researcher: Immediate feedback.

User 4: Not immediate or maybe I ask a question and somebody replies..

Researcher: maybe you are talking about post where you ask a question and come on the screen and somebody else replies.

User 4: It is not a chat room…

Researcher: yes not a chat room

User 4: It has some service enquiry or something.

Researcher: You mean like a thread.

User 4: Thread will be good but even I don't know what they call, but instead of emailing through the contact they have a form and you have enquiries at and somebody gets back to you. That will be good personalisation.

Researcher: That s good it is more personalisation and it gives an opportunity to users that they are valued, they have answered my question….

User 4: I think I also quiet like the sense that the group (organisation) knows a lot about the sports that they are involved with. Say for eg., they have tips and tricks of today's is guess,…something, even if wasn't the sport my kid was involved with some profile person will be quiet good. Again it is a re assurance that it is not just a sport body, it is affiliated with and it is like a sports hub. Hub for the sort of action

Researcher: emmmm that's good. Because it is more targeted to teenagers so there should be something to hold their attention.

User 4: Or even training tips, diet tips, infact know I talk more about it, the idea of becoming more than just a place to advertise one programme it becomes a sports hub will be very interesting. I think.

Researcher: That's really nice and it is a new idea..

User 4: That would rally appeal to me and I know if I people in that age group, they will be more interested in that in knowing that where they go to has these connections and like a family almost.

Researcher: For them it is a virtual society.

User 4: Or even that I wonder there is link to social network like face book or twitter and stuff of that. You have normal visit our facebook page; ii will be quiet active and talking to each other.

Researcher: That's good. It is a new idea. Do the look and feel of the matter to you?

User 4: Yes

Researcher: How much

User 4: Again I want it to be appropriate; I don't want it to look like flash or some sort of catering site or some artist site something. It just got be professional and appropriate. So I guess I want it to look like foundation for sports and don't know what they look like but I like it to be assured that it is same kind of calibre like Australian sports. Whatever those are. I don't want to look like a spare job fixing someone's tyre…I don't want it look like an university website either, so maybe like lifestyle magazine might be quiet cool but not too old.

Researcher: That's good

Researcher: Anything else regarding website as user you think it should have?

User 4: I get annoyed that take too long time to load, maybe that is the common thing..

Researcher: It is not common thing…

User 4..ok

Researcher: Those who have taken care of images and too many things of animation then it are a problem.

User 4: I even get annoyed unless I know it is going to be super animation.

Researcher: Do you get annoyed if there s too much content in the first page?

User 4: I mean it is something like menu is clear and in the center a video or a scrolling bar or something….

For parents, for athlete I find it using on banks website where they have login for business, personal use etc…

Researcher: so it is a huge area and they have categorised from the start.

Researcher: Thanks.

A.3. Second Round Interview Transcripts

This appendix contains selections from interviews conducted in the second round of the design phase. The names of the interviewee have been changed to preserve their confidentiality.

Interview One

Personal Questions:

Researcher: Do you as a user seeing this layout your needs and requirements has been integrated in design?

User: Ya I would say so, because as I said last time they usually like the credentials and it seems it is here.

Researcher: There are some testimonials as well about some coaches.

User: I think it is being pretty well provided with all information. Cannot think of anything that is missing.

San: Ok

Researcher: So seeing this if you are a student, will you trust this organisation to invest? The layout, the content gives you enough trust to invest in this?

User: emmmm Think is with the big reliable universities other trust worthy institutions, they don't have thing like join now , it is free and other stuff like that and also this kind of table here with price is almost looks like another dodgy line wire type of website.

Researcher: So how do you prefer?

User: But cannot say exactly, but a good place start with will be study another university websites.

Researcher: So as a person you have certain needs and you have a certain level of value for yourself, so do you think the designer has valued you as a person?

User: emmm.. Yaa I guess so.

Researcher: When we go to any shop or you buy something you expect a level of customer service, but virtually it is different so do you getting any level of customer service or certain things are missing because it is all in business?

User:Ya.. I am getting because they give you a nice overview of what it is, who they are, they have a contact us page, call back section and all.
San: ya…

Researcher: When you give your initial feedback you have some requirements, you said what you think about the website, do you think the designer has integrate that opinion properly?

User: More or less but I would change the layout if I could. Just things they seem to be too aggressive with that, trying too hard to get the students, in things like call back, submit a comment , get you to register.

Researcher: You prefer more like an informative and informational website?

User: Ya…..Like jin now we will give you something, like almost every page has that.
Researcher: Fair enough…

Psychological Questions

Researcher: This is a static website, but if is interactive what challenges do you think you can face, like maybe navigation wise, or you have to remember something and go to the next section…Like sometimes when you use website you feel it is a learning curve?

User: emmmmm.emmmm

Researcher: Is it easy to find information or do you have to put pressure on you brains?

User: I think they have done a pretty good job. Emmm It is pretty easy to find everything.

Researcher: Ok..

User: All I want is information maybe, credentials, maybe how to get there and pretty all..

Researcher: Do you have an emotional feeling toward this?

User: No..

Researcher: You have seen few E-business website like online business, like trade me how well they have integrate needs?

User: is there any feedback page here where students can get the feedback or were you can see feedback?

Researcher: Is this feedback form or maybe blog?

User: No that type. I am talking like where students can comment or get feedback on the institutions.

Researcher: Ok like reviews about institutions..

User: Ya…

Researcher: No they don't have.

User: Then, They should have something may be links to other websites reviewing the institutes itself.

Researcher: That is a good thing for establishing credentials.

User: That makes you feel trust I think.

Researcher: Again coming back to this is static, if it is interactive how comfortable will you be to interact with this website, in the sense like clicks your hand movement, you neck or concentration of your eyes?

User: Ya.. I guess so pretty interactive. Pretty easy and all type of website. The layout is not alien to me. So I will feel pretty comfortable.

Researcher: So you will not have any discomfort in using mouse and clicking the links?

User: No…na..

Ergonomics Questions

Researcher: How do you describe the interface in terms of its simplicity in use?

User: It is very simple.

Researcher: User friendly.

User: Yes it is user friendly, everything is provided pretty easily. You want everything in the main page.

Researcher: So you don't face any challenge while interacting with this?

User: na…

Researcher: For performing and remembering task it is easy for you?

User: ya… very easy . Well personally what I do is when I am searching for a new website everytime I am looking I open a new tab for everything so that you can refer back. It seems pretty easy.

Researcher: What about regarding the clarity of text, the colour, links, the contrast of it?

User: ya I guess…

Sociological Questions

Researcher: Do you think the designer understands your existing world, your trend in the world?

User: As far as sports goes, I would say ya..emmm

Researcher: Because youtube, facebook are the current trend in teenagers environment.

Researcher: Does it provoke anything? You know if you see a website you feel, and get negative vibes or against a social or ethics.

User: No..nothing as I said only thing that puts me off here s the join now, submit a comment and all those….

Researcher: When you go any business they try to build a connection with you.

User: yaa. This website is more like a business than an education institute.

Researcher: That is a good comment….

Researcher: It does seem like a corporate look and feel. So when you go for a business they try to build a connection with their customers like enrolling for newsletter, or for on going promotion. Do you anything like that in this website?

User: Yaa.. Like every page just the way they are talking every chance they get they are trying to get some connection with the users. Like when someone puts an comment again they get the email addresses and can get newsletter, if they ask for a call back that is another connection.. you know….

Researcher: Ya… true…..

Researcher: Would you recommend this site to anyone? Hypothetically,

User: Well yaa. I would recommend if someone were really good at sports and wanting to go somewhere I would recommend. There is no reason not to.

Researcher: So it is according to your social standard?

User: ya….

Researcher: You don't have much content in this but seeing the links name and content, are you comfortable with the language they have used? It is not like bro town…

User: Na.. it seems fairly professional and …

Researcher: Do you expect this from sports organisation?

User:: ya definitely, if they have been affiliate with top university then they should.

Researcher: So do you think they should tell about the other university as well?

User: ya.. I think more often and not just one….

Researcher: That's it… Thanks

A.4. Quotes from the Third Round of Interviews

"It seems more legit website now, it seems more trustworthy. I think at some parts they have over done it but it is a good website. It seems like decent website. I feel confident with the credibility of the organisation".

"Yes I supposed, it does give you a fair amount of information. This seems decent as it says what he is good and what university he is going to and other details. At least it seems, more trustworthy now, at first it seemed as if they are trying to sell something but now they have added testimonials as well".

"I would tend to go and explore the website and look at that sort of personal testimonials, or case history and I don't think I question the fact the site is reputable or not. I think we have to make communication before. As it is it looks very authoritative".

"I see that is good. Sure if I was in a position I would probably ask them for testimonials that I could contact. I think the video is great, I don't think you are getting more information but you are getting different way of information that is more appealing to the age group. It is better reading that text. That is a good balance. Play Atlantic comes across as very authoritative and blue is a good colour for that. It is really good and a great idea. The two target groups the students and the parents are well covered".

"I think it is pretty good from what I can see. It would have probably helped me when I was on the list of sports universities".

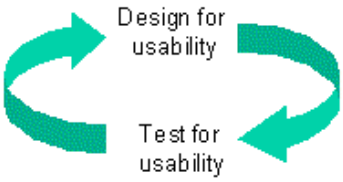
A.5. Brief Explanation of Existing Design Process

This appendix contains brief explanation of the existing design process provided to designer during expert review analysis.

1. Usability Design Process - Nielsen

Steps involved in the design process:

- Involve your users from beginning
- Know your users
- Analyse users tasks and goals
- Explore different design approaches
- Test for usability



2. Iterative Design Process - Lowe and Eklund

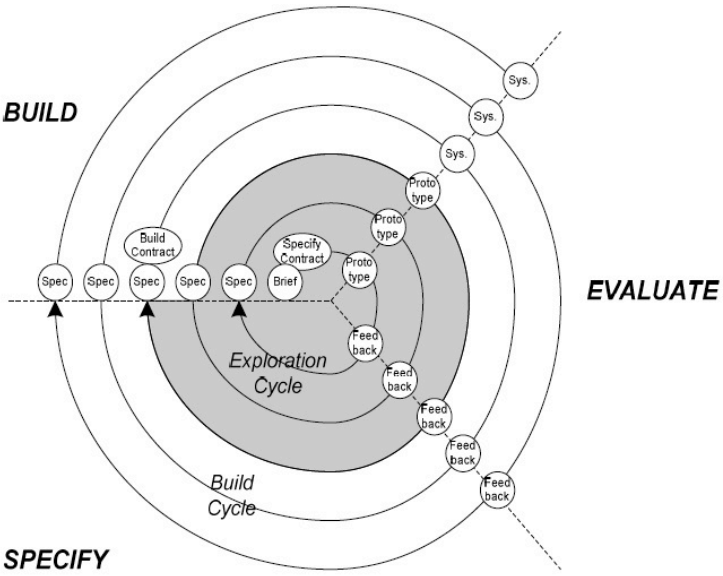
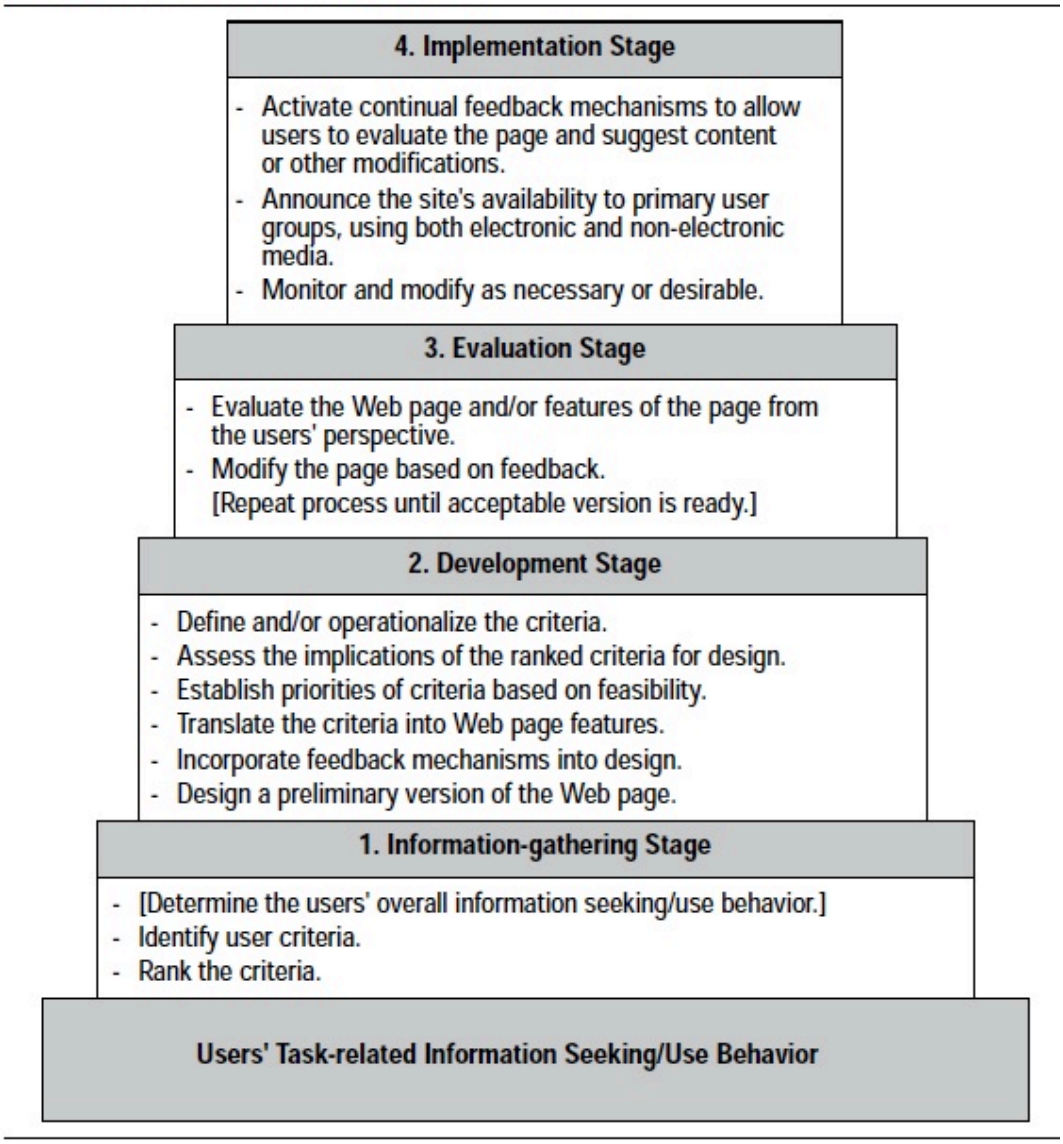


Figure 1 An iterative design model.

Steps involved in the design process:

- Identify the needs of the clients using interview process
- Build the website using design methods and web technology
- Evaluate the website with the clients.

3. User Based Design Process - Abels and others



4. Participatory Design Process – Spinuzzi

Steps involved in the process:

1. Initial exploration of work - using observation, interview and walkthroughs.

2. Discovery processes

   In this stage, allows designers and users to clarify goals and values and agree to a common outcome.

3. Prototyping

   In this stage, designers and users create technological artefacts to fit to the initial requirements. This step is repeated several times.

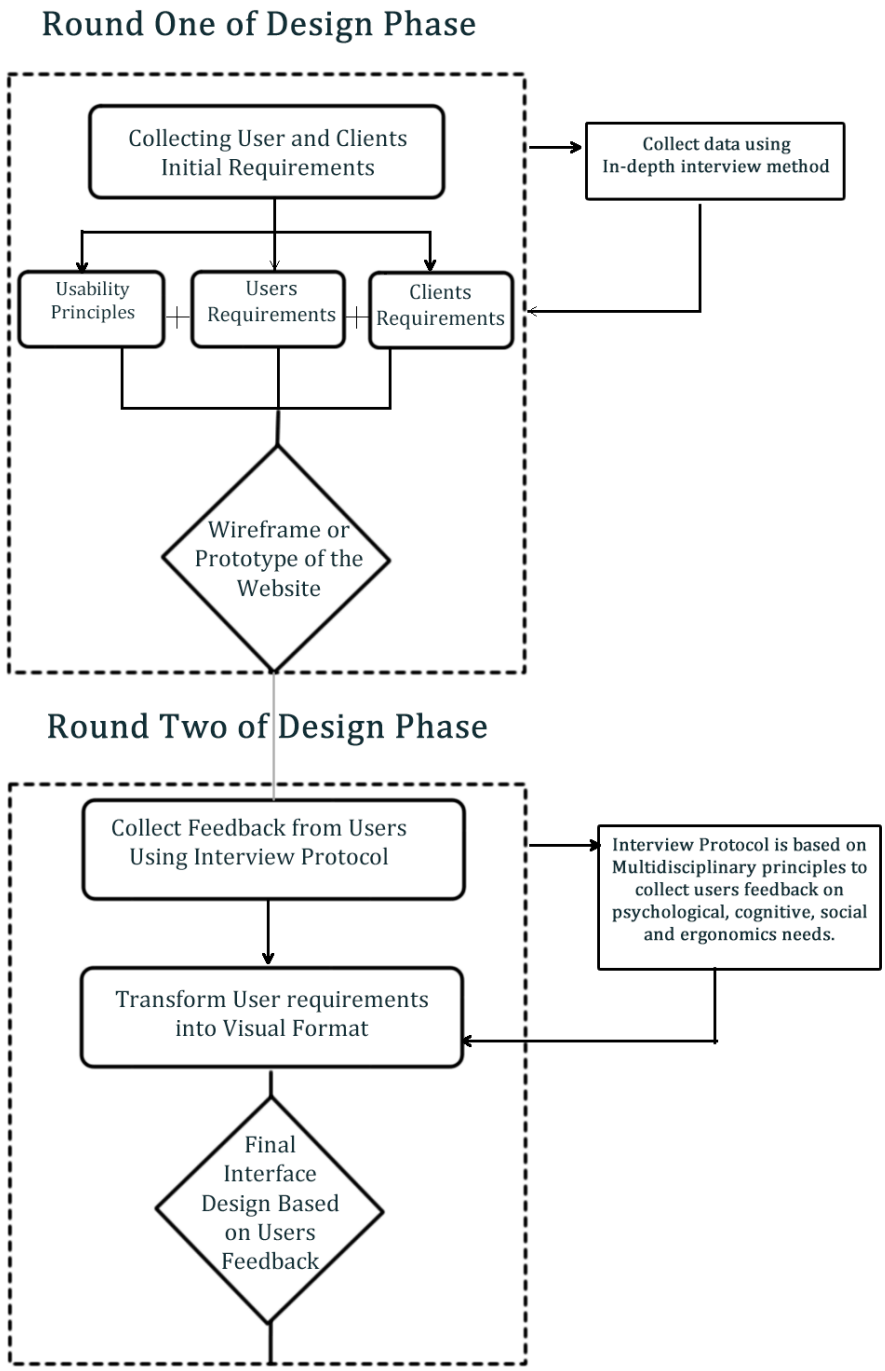
4. Evaluation

   The outcome is evaluated by usability testing

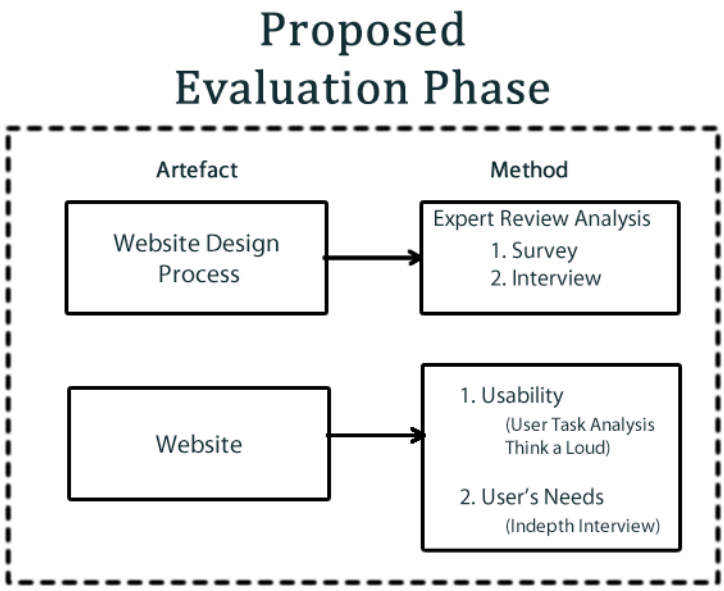
6. Multidisciplinary Design Process - Sangeeta Karmokar

The Design Process Consist of two Phases: Design and Evaluation Phase

1. Design Phase
   a. Round One- Usability Integration
   b. Round Two – Emotional, psychological, cognitive and social needs integration



1. Evaluation Phase



Users' Needs:

- *Psychological Needs*: Users knowledge, mentality, thinking, reaction, intuition, memory, pleasurable experience.
- *Emotional Needs:* Feeling, trust, security, safe, fear, loyalty and belongingness.
- *Physical Needs*: Language, environment, movement of eyes, task performed on the website, arrangement of the content and features of the website.
- *Social Needs*: cultural and social background, values, community, things they care about, family values and environmental value

A.6. Examples of Transcribed Data from Expert Review Analysis

This appendix contains selections from interviews conducted during the expert review analysis. The names of the interviewees have been changed to preserve their confidentiality.

Designer 1

(Nielsen, 1993)

Designer: There is so much lacking as not enough time spend at the beginning that a year later they come back and find so much lacking.

Researcher: Please do a comparison

Designer: The difference between these two is that the beginning phase is very similar to participatory and user based design but they missed this step and went straight into evaluation step. Let go design a site and do evaluation.

Researcher: Do you think step is important?

Designer: Yes it is intensive, if you have everything sorted in the design process the less likely you going to redo things, fix the problem etc. Because you were busy fixing usability problem and missed the user based needs. If you have looking at all the emotion, psychological and other aspects needs, so that when you go the design done, you know it is going to work.

Researcher: So as a designer do you think currently they have any process or are they doing any of these steps involved?

Designer: Generally there is lot of honest put on designer that designer knows everything, go away and do the design and give me what I want. There is no communication process on usability or any other aspect generally. There is no time allowed to that, to be no though put into the aspect of it and it stumbles after the design.

Researcher: You said time, so is it the time or it is the process

Designer: It is cost and time. Small business may say no as they have no monetary funding to carry the process. For bigger companies this is good process.

Researcher: My idea was to do for SMEs because in NZ we have many SMEs.

Designer: Well if it is staged process with very clear steps laid out like you have got here, it makes a lot easier to follow a system. There is no system, there are no clear process which we designer use. If there is a laid out system which we follow then we can sit down with our client and say this is how we are going to do it, these are the steps we are going to do together and this makes a lot easier.

Researcher: Can u compare with these and this?

Designer: The new process is intensive and it is easier for client to follow as well and it can be used for a lot of different site. I like user-based process, it is similar but this one is lot intensive in round two.

Designer 2

There are no models in web design area, everything just grows from no where.

Researcher: Comparison

Designer: The first and most important thing is, it is a multistage process. Other one is like iterative process; it is repeating its steps. So if your data is wrong in the first place then you will be wrong in every case because you are applying the same structure over and over. This process has structure is not iterative; it has stages so you phase it. The first phase does certain things and leads to second phase. The only thing I would say is the make sure you don't miss anything when moving from1 phase to 2 phase so that there is a review section. But what I see it is very through, I think I have used somewhere unconsciously but never heard on any process as such.

A lot of us do he evaluation here in the round 1 but you have gone a step ahead and included other needs and then done then evaluation. I liked the evaluation as well. It is very rigours. We don't like going to other people or designer to get opinion about our design. As long as people are constructive about the criticism then I don't have a problem. When you go to a practitioner you can see a different view point a more heuristic evaluation of your design. You have got all basis covered plus usability and very through. I am impressed. This system is way ahead of all.

I would combine iterative process and user based design but the new system is way ahead of all. Most of the evaluation is using a very narrow criteria such as it is making enough money or am I getting more hits or high enough on search engine but they are not how it is ranking with my users, what is my users feedback. Lot of them have no idea what is feedback is, some of them do have. Gain it depends method of evaluation and where it is coming from. This new process has all the bases covered as users and experts are evaluating the design.

The web is about trust and user needs to trust your computer Interface. The level of trust has to be built up with the user, computer has no emotion but you need to get hold of it somehow.

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