Integration and Acceptance of Web 2.0 Technologies in Higher Education

by

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To my parents...
Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma, except where due reference is made in the text of the thesis. To the best of my knowledge, this thesis contains no material previously published or written by another person except where due reference is made in the text of the thesis.

Nauman Saeed

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Abstract

Web 2.0 is a made up concoction of the second generation of Web-based applications powered by interactions and online communities. These include (but are not limited to) blogs, wikis, multi-media sharing services, content syndication, podcasts, content tagging services, and multi-user virtual environments. With the creation of such applications, the Web has been transformed into a fully interactive space allowing any user to collaborate, create, publish, subscribe, and share information.

More recently, Web 2.0 has become a buzz-word in education and academics around the world have been exploring the potential of Web 2.0 technologies in both online and classroom-based teaching. However, the opportunities presented via technologies are coupled with challenges: how to accommodate the diverse needs of students; to what extent is the technology useful; and, how to make right decisions for specific learning tasks. This thesis answers such questions by conducting two case studies involving popular Web 2.0 technologies in a classroom-based higher education setting, using a student-centred approach. This was accomplished by integrating a combination of blog, social bookmarks and podcasts in Web programming units, based on the match between students’ learning styles and their preferences for using Web 2.0 technologies. The findings highlighted learning styles and technology preferences of the current generation of students; usage patterns of Web 2.0 technologies in higher education; student satisfaction for the use of incorporated technologies; and finally, well-balanced academic performances across all learner types. These findings can serve as a guideline for academics or practitioners looking to integrate Web 2.0 technologies in their unit designs.

There are also growing concerns about the gap between popularity and usefulness of Web 2.0 technologies and their adoption in higher education environments. These
concerns give rise to further questions like: what motivates people to use Web 2.0 technologies; how to encourage people to use Web 2.0 technologies or make full use of them; and, what the significant predictors of Web 2.0 usage are? Here, to answer these questions, we examined the user acceptance of some popular Web 2.0 technologies like blogs, podcasts, and Second Life (a 3-D multi-user virtual environment) and key predictors of their usage in higher education context.

The aforementioned issues were met by conducting two survey studies. In the first study, a theoretical model was formulated to examine the effect of students’ cognitive styles on user acceptance of blogs and podcasts, based on the technology acceptance model (TAM) and adaption-innovation (A-I) theory. The empirical evaluation of the proposed model was performed in PLS (Partial Least Squares) using PLS Graph 3.0 software. The findings provided full support for the proposed model and highlighted the technology usage patterns of adaptive and innovative cognitive styles. The data collected during the first survey study also helped in examining the effect of media richness on user acceptance of blogs and podcasts. This was done by formulating another theoretical model based on TAM and media richness theory (MRT) and treating perceived media richness (PMR) as significant antecedent of usage intentions of blogs and podcasts. The empirical evaluation of the model revealed significant effect of PMR on use intentions but defied dominance of rich medium (audio/video-based podcast) over lean medium (text-based blog) in terms of explaining user acceptance of blogs and podcasts.

The second survey study extended the research on Web 2.0 technologies by examining user acceptance of a popular 3-D virtual learning environment, Second Life. To do this, a theoretical model was formulated based on TAM and hedonic consumption behaviours from marketing research. The empirical evaluation of the proposed model underlined the highly significant effect of hedonic behaviours (in terms of emotional responses) on user acceptance of Second Life. The findings also exposed the inability of traditional technology acceptance approaches (such as TAM) to explain the user acceptance of today’s highly interactive, multi-user, and entertainment-oriented technologies like Second Life thus triggered the need for more research on user acceptance of Web 2.0 technologies.
The contributions made by this thesis are multi fold: 1) It presents an overview of prominent learning theories which helped in explaining the notions of student-centred learning, e-learning and the role of Web-based technologies in e-learning. 2) It explains the notion of Web 2.0; describes the academic usage of selected Web 2.0 technologies; and, pinpoints the challenges of using Web based technologies in higher education settings. 3) It presents an overview of technology acceptance theory and an overview of key technology acceptance models / frameworks from Information Systems research. 4) It also investigates the fields of social psychology, marketing, communication and consumer behaviour in order to explore key predictors of Web 2.0 usage. 5) The two case studies reported in this thesis validate the importance of matching learning styles with instructional preferences and contribute toward the practice of Web 2.0 technologies in higher education. 6) The thesis also contributes toward the field of technology acceptance by formulating theoretical models on user acceptance of blogs, podcasts and Second Life and performing empirical evaluation of the proposed models. This would help in improving the Web 2.0 usage in higher education.
The Author’s Publications

Book Chapter


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Chapter 1: Introduction

1 Introduction

E-learning is the delivery of training and learning using means of electronic media, such as computers, Internet or intranet (Tastle, White, & Shackleton, 2005). Three basic ingredients of e-learning constitute: content and instructional methods; ways of delivering content and methods; and achievement of personal and organisational goals. These ingredients are also referred as the *what*, *how* and *why* elements of e-learning respectively (Clark & Mayer, 2008). This thesis mainly focuses on the *how* element in terms of exploring the integration of emerging Web technologies in unit teaching; finding novel ways of combining technologies to facilitate a wide spectrum of learners; examining user acceptance of emerging Web technologies; and predicting significant determinants of such usage within the higher education context.

As evident from the above definition of e-learning, the Internet or Web is an integral part of the delivery of training and learning. With growing Internet speeds and decreasing hardware costs the Web is becoming a major part of every-day’s life. More recently, *Web 2.0* has become a buzz-word in education and wider circles which has transformed the way people have used the Web, from passive to active users (Cleary, 2008). Although there is no clear definition of Web 2.0, it is considered as a perceived second generation of Web-based interactions, applications and communities (Duffy, 2008). O’Reilly media, who coined the term Web 2.0 in 2003, described it as a set of principles and practices that tie together a veritable solar system of sites that demonstrates some or all of those principles, at a variable distance from that core (O'Reilly, 2005). Web 2.0 is also referred as the *read / write* Web which is very close to the idea of the original Web developer, Tim Berners-Lee, as a collaborative medium where people meet, read and write (Richardson, 2006). There are a number of Web 2.0 technologies, services or applications that demonstrate the foundations of the Web 2.0 concepts / principles and they are already being used to a certain extent in education (Anderson, 2007). These include blogs, wikis, multimedia sharing services, content
syndication, podcasting, content tagging services and multi-user virtual environments. With the creation of such applications, the Web has been transformed into a fully interactive space allowing any user to collaborate, create, publish, subscribe, and share information (Asmus, Bonner, Esterhay, Lechner, & Rentfrow, 2005). However the opportunities presented via new technologies are coupled with challenges, such as: how to accommodate the needs of diversified range and requirements of student population; how learners manage, strive and thrive in this information era with huge amounts of information available; to what extent the use of technology is useful and to what extent these tools should be encouraged; and, how to make correct selection decisions for specific learning tasks (Webster & Murphy, 2008). Moreover, there are concerns about student perceptions and experiences of e-learning with less reported empirical findings. These concerns include: factors that influence student participation in e-learning activities and use of technology; student personal technical knowledge and skills; and, perceptions of usefulness of e-learning (Wang, 2008). This thesis addresses the above issues by integrating emerging Web technologies in unit teaching based on the match between students’ learning styles and technology preferences (Saeed & Yang, 2008b; Saeed, Yang, & Sinnappan, 2009b).

Despite the promising potential of e-learning, there is a growing concern in the research community that focusing only on delivering learning content leads to isolation, low motivation, and passive behaviour among learners and thus causes large dropouts from e-learning participation (Hummel, Manderveld, Tattersall, & Koper, 2004; O’Connor, Sceiford, Wang, Foucar-Szocki, & Griffen, 2003). One important component that has been overlooked here is the social component (Turani, 2007), which is addressed by this thesis. This has been achieved by integrating a set of social applications such as blogs and social bookmarks in unit teaching in order to enhance collaboration among learners and to overcome the problems of isolation and passive behaviour (Saeed & Yang, 2008a).

A careful look at some recent studies suggests that the uptake of e-learning is generally growing (M. Bell, Bush, Nicholson, O’Brien, & Tran, 2002; HEFCE, 2006; Hodgson, 2002; OECD, 2005). A survey of the US undergraduate students in 2006 found that on average they spent 23 hours a week using technologies (Katz, 2006). Studies in
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Australia, New Zealand and the UK also indicate Web-based e-learning as a dominant mode in higher education (Marshall, 2005). An Australian study in 2005 found that nearly 95% students had Web access at home and 78% considered themselves as expert in using computers (Krause, Hartley, James, & McInnis, 2005). Hence, there is clear evidence that students from Australia and the rest of the world expect to use online technologies as a major part of their study (Russel, 2008). However, there is a need to provide them with optimal ways of utilising technology in their training and learning, which is the main drive of this thesis.

Even with the use of emerging technologies there are concerns in the educational community about the gaps between the popularity (usefulness) and low penetration rates of Web 2.0 technologies in education. These concerns give rise to further questions like: how to encourage more people to use Web 2.0 technologies for teaching and learning; how to motivate experienced users to use these technologies more frequently or make full use of them. This thesis attempts to fill such gaps by exploring key determinants of technology usage and examining user acceptance of some prominent Web 2.0 technologies like blogs, podcasts and Second Life (a 3-D multi-user virtual environment, http://secondlife.com/) in order to improve their usage in academic settings (Saeed, Yang, & Sinnappan, 2009a, 2009c).

1.1 Context of the research

This research fits into two fields: e-learning and technology acceptance. The e-learning part focuses on the use of Web-based technologies to facilitate teaching and learning in higher education, which further narrows down to the integration of Web 2.0 technologies in unit teaching. A learner-centred approach has been formulated to integrate a combination of Web 2.0 technologies in unit teaching in a higher education setting. The study participants comprised undergraduate and postgraduate students from Faculty of Information and Communication Technologies (ICT) in Swinburne University of Technology (SUT) hence the scope of this research mainly lies in the IT education. The student-centred approach involved integration of Web 2.0 technologies
in unit teaching by matching students’ learning styles with their technology preferences. The author also served as a tutor in those units where the user studies were conducted.

The second part of the research focuses on exploring key determinants and examining user acceptance of some prominent Web 2.0 technologies in higher education context. To investigate the key determinants of Web 2.0 technologies, a thorough literature review was carried out in a variety of disciplines including: Information Systems (IS), technology acceptance, social psychology, cognitive learning, consumer behaviour, marketing, advertising, and communication theory. Following an intensive review of various technology acceptance theories / models from the IS literature, the technology acceptance model (TAM) from Davis (Davis, 1989) was chosen as a base-line to conduct further research on user acceptance of Web 2.0 technologies, using the following rationale:

- TAM specifies general determinants of individual technology acceptance which can be applied to explain or predict individual behaviours across a broad range of end user computing technologies and user groups (Davis, Bagozzi, & Warshaw, 1989);

- TAM is considered powerful, robust and parsimonious for predicting user acceptance of a variety of new technologies (Napaporn, 2007; Raaij & Schepers, 2008);

- TAM incorporates findings accumulated from over a decade of IS research, it may be especially well suited for modelling computer acceptance (Davis, et al., 1989);

- TAM has been theoretically justified and validated for a variety of Web-based applications (Napaporn, 2007), Web browsers (Morris & Dillon, 1997), Web-based learning systems (Halawi & McCarthy, 2007), multimedia learning systems (Saade, Nebebe, & Tan, 2007) and Web usage behaviour (Shih, 2004).
To investigate the user acceptance of Web 2.0 technologies in higher education, two separate survey studies were conducted on three prominent Web 2.0 technologies, namely blogs, podcasts and Second Life. The selection of blog and podcast technologies was made to further explore these two technologies based on the outcomes of the earlier case studies (reported in Chapter 4). The selection of Second Life was made due to several reasons. First, Second Life blends well with the main theme of this thesis, i.e., exploring the use of Web 2.0 technologies in higher education. Second, it emerged as a significant and very popular virtual learning environment during the course of this doctoral research. Finally, Swinburne was in the process of establishing its own virtual campus in Second Life at the later stages of this research and academics at Swinburne were very keen in exploring the academic usage of this immersive virtual learning environment.

The first survey examined the effect of students’ cognitive styles and perceived media richness on user acceptance of blogs and podcasts while the second survey study examined the effect of hedonic consumption behaviours on user acceptance of Second Life. Empirical evaluation of the proposed models were carried out using the PLS (Partial Least Squares) approach, which is a variance-based latent variable structural equation modelling technique for analysing structural models involving multiple constructs and multiple indicators (Chin, 1998b).

1.2 Research problem

The main problem addressed by this research is the lack of technology usage in higher education. More specifically, this research concentrates on finding effective ways of integrating Web 2.0 technologies in higher education. The literature on e-learning practices outlines the potential of technology as an agent for change in higher education (Oliver & Herrington, 2002). However, it also reports on the slow progress in uptake of technologies despite a vast improvement in online learning management systems and other Web-based tools (Herrington, Oliver, & Reeves, 2003). Despite the growing knowledge on theoretical and practical understanding of how Web-based technologies facilitate student learning experience, the current e-learning literature fails to justify
why many academics in Australia or elsewhere have been slow to act upon this knowledge and are largely failing to use even well established e-learning technologies effectively (Russel, 2008). Although some recent studies have reported a rise in the use and adoption of Web 2.0 technologies in higher education (NMC & EDUCAUSE, 2006, 2008, 2009; Pulichino, 2006), questions remain on their effectiveness and long term usage (Divitini, Haugalokken, & Morken, 2005; Shin & Kim, 2008; Webster & Murphy, 2008). Even the academic literature on user acceptance of Web 2.0 technologies is scarce, mainly due to their infancy.

Investigation of technology acceptance by target users has received considerable attention from researchers and practitioners. Several theories and models attempt to explain or predict a person’s decision to accept a new technology (Chakraborty, Hu, & Cui, 2008). However, some inconsistencies exist among their key determinants and a large number of researchers are keen in investigating whether these theories and models should be revised, extended or modified to account for rapid change in both technologies and their environment (Napaporn, 2007). There are also growing concerns that the traditional approaches of technology acceptance may not be able to explain the usage of today’s highly interactive, multi-user and entertainment oriented technologies (Heijden, 2004; C. L. Hsu & Lu, 2004; Koufaris, 2002). Therefore it is important to take a fresh look at these approaches in the light of unique Web 2.0 features in order to predict their usage more accurately.

### 1.3 Aim of the research

The aim of this research is to improve usage of emerging Web-based technologies to facilitate training and learning in higher education. This aim can be divided into two objectives:

1. **Finding effective ways of integrating Web 2.0 technologies in higher education.**

   This research aims at integrating Web 2.0 technologies in unit teaching based on student-centred approach. This objective is achieved by conducting user studies...
with selected Web 2.0 technologies and integrating them in unit teaching based on the match between students’ learning styles and technology preferences, as explained in Chapter 4. The study outcomes provide the initial platform to further investigate Web 2.0 usage employing well established technology acceptance theory.

2. Examining key determinants and user acceptance of Web 2.0 technologies in higher education.

This research aims at exploring key determinants and examining user acceptance of some prominent Web 2.0 technologies within higher education. This objective is achieved by conducting studies about user acceptance of blogs, podcasts and Second Life as explained in Chapters 5, 6 and 7. This research helps in highlighting the key determinants of Web 2.0 usage and suggesting ways of improving their academic usage.

1.4 Outline of the thesis

Chapter 1 provides a brief introduction to the background of the study along with the research problem. The chapter also outlines the context of this study together with the key objectives and structure of the thesis.

Chapter 2 reviews the literature on various learning theories/approaches including the details on individual learning styles. The chapter explains the concept of e-learning and the influence of Web technologies in e-learning. The notion of Web 2.0 is explained along with details of selected Web 2.0 technologies. The chapter also discusses various technology acceptance approaches with key emphasis on Davis’s Technology Acceptance Model (TAM).

Chapter 3 describes the rationale behind choosing the adopted research methodologies in this thesis. The details include case study and survey design; ethics clearance; questionnaire development; data planning; and reporting procedures.
Chapter 4 presents details of the two case studies on integrating Web 2.0 technologies in unit teaching. The first case study helped in implementing a unit blog, a unit bookmarks page and series of lecture podcasts in an introductory Web programming unit based on the match between students’ learning styles and preferences for Web 2.0 technologies. The study outcomes revealed higher satisfaction levels from study participants and well-balanced academic performances across all learner types. The second case study reported in Chapter 4 also fulfilled its intended purpose by replicating the outcomes of the first case study.

Chapter 5 presents details of the empirical study on user acceptance of blogs and podcasts in higher education. A theoretical model was formulated to examine the effect of students’ cognitive style on user acceptance of blogs and podcasts, based on Davis’s technology acceptance model (TAM) and Kirton’s adaption-innovation (A-I) theory. The empirical evaluation (using PLS) of the proposed model demonstrated significant effect of cognitive style construct on perceived usefulness and perceived ease-of-use of blogs and podcasts which finally drove the intentions to use. The findings also highlighted the technology usage patterns of innovative and adaptive cognitive styles. The chapter also discusses the study findings, theoretical contributions, limitations, and research and practical implications.

Chapter 6 follows the research on user acceptance of blogs and podcasts by formulating a model to examine the effect of media richness on user acceptance of blogs and podcasts, based on TAM and media richness theory (MRT). The empirical evaluation of the proposed model confirmed the significant effect of media richness on usage intentions of blogs and podcast but defied the dominance of rich medium (audio/video-based podcasts) over lean medium (text-based blog) in explaining the user acceptance.

Chapter 7 extends this research by conducting a study on user acceptance of another popular Web 2.0 technology, Second Life. Instead of focusing on the traditional motivational user behaviours this study focused on examining the effect of hedonic consumption behaviours on user acceptance of Second Life. The empirical evaluation of the proposed model demonstrated highly significant effect of emotional responses on user acceptance of Second Life. The findings also exposed the inability of traditional
technology acceptance approaches in explaining user acceptance of today’s highly interactive, multi-user and entertainment-oriented technologies.

Chapter 8 concludes the thesis by summarising the original findings and key contributions of this thesis. The chapter also presents some directions for future research.
2 Background and Literature Review

This chapter helps in formulating the theoretical base of the thesis. It starts with the definition of learning followed by an overview of various learning theories and their implications on e-learning. We particularly emphasise on the social constructivist approach that forms the very basis of e-learning. With a student-centred approach in mind, this chapter presents details on learners’ characteristics in terms of learning styles and an overview of some prominent learning style theories / models. It further highlights the impact of learners’ personality traits on their instructional preferences including the use of Web technologies. The chapter then discusses the importance of the Web to facilitate e-learning followed by an overview of the revolutionary Web 2.0 concept and its impact on the practice of e-learning. An overview of the selected Web 2.0 technologies that are investigated in this thesis is presented along with some examples of their use in higher education. The chapter also draws attention toward drawbacks of using Web 2.0 technologies and the hindrances that exist in the academic usage of Web 2.0 technologies. This leads to the discussion on technology acceptance theory and an overview of some prominent technology acceptance approaches / models. More emphasis is given on the technology acceptance model (TAM) which has been used in this thesis as a baseline to examine user acceptance of the selected Web 2.0 technologies. The chapter also justifies the selection of TAM for this research and concludes with a summary.

2.1 The nature of learning

In order to investigate the use of e-learning technologies it is important to understand the notion of learning in the context of various learning theories. It is also important to understand the implications of various learning theories for the development of e-
learning environments and to know which learning approach forms the basis for e-
learning.

The American Heritage Dictionary defines \textit{learning} as follows: “to gain knowledge, comprehension, or mastery through experience or study”. However, a more concise definition of learning would be “a change in observable behaviour as a result of individual experience” (Kimble, 1961). It is evident from the above definitions that learning experience is \textit{unique} to each individual and therefore needs to be addressed in academic learning. However, in order to address the notion of unique learning experience, it is important to understand how various learning theories explain the process of learning and how they support the individual learning experience? It is also important to explore what implications these learning theories have on the design of e-learning or technology-based education. In the next section, we present an overview of some prominent learning theories namely: behaviourism, cognitivism, and constructivism and their implications for the design of e-learning environments.

\section*{2.2 Learning Theories}

\subsection*{2.2.1 Behaviourism}

The behavioural approach to learning has been a dominant psychological approach in the design of curriculum and educational technology. Most of the behaviourists agree on the fact that instruction should have specific goal(s) and instruction material should be presented sequentially by first presenting simple facts followed by more complex information (Gillani, 2003). The behavioural approach asserts that learning manifests itself in behaviour (either changed or reinforced), and behaviour can be conditioned through a system of punishments and rewards (Elliott, 2009). Behaviourism is primarily associated with Pavlov’s theory of \textit{classical conditioning}, Skinner’s theory of \textit{operant conditioning} and Thorndike’s theory of \textit{connectionism} (Rawlings, Skouteris, & Whitechurch, 2004). \textit{Classical conditioning} refers to a learning process that occurs through associations between an environmental stimulus and a naturally occurring
stimulus (Gillani, 2003) while operant conditioning is another kind of associative learning process which occurs if the operant responses (certain responses that a human has the innate propensity to acquire) are properly reinforced, and then they become rooted in human behaviour (Skinner, 1974). Connectionism refers to learning as a process of habit formation, or forming a connection between stimulus and response (Gillani, 2003). Early behaviourist approaches treated every learner as equal and learning was thought to be reactive with little or no differentiation between individuals (Wolf, 2007). In the classroom settings, behaviourism implies the dominance of teacher who is responsible for training the learner. Learning in such environments takes place in a highly controlled environment with little or no emphasis on the mental processes taking place within the learners’ mind thus considering it as a ‘black box’ (Elliott, 2009).

The principles of behavioural learning have been applied to several instructional models such as Mastery Learning, Programmed Instruction and Direct Instruction Model. During 1960s, the contributions of Patrick Suppes and his colleagues at Stanford University formed the basis of an instructional model called practice and drill or tutorials. This model was based on Mastery Learning approach and formed the basis of behaviourism application in educational technology. The applications of computer-assisted instruction carried out by Suppes in the 1960s has come a long way and can be seen today in the form of sophisticated multimedia tutorials on CDs or Web sites.

2.2.2 Cognitivism

Cognitivist revolution replaced behaviourism in the middle of the last century because many theorists were not satisfied with the mechanistic view of behaviourism and argued that learning would be extremely inefficient if individuals had to rely completely on conditioning for all their learning (Chomsky, 1972). Cognitivism is primarily associated with the work of Die Gestalt, Jean Piaget and several other researchers like David Ausubel, Jerome Bruner and John Flavell. Cognitivism is a learning paradigm based on the theories of cognition, where cognition is “the process of acquisition, storage, transformation and use of knowledge to solve problems” (Matlin, 2002). Thus cognitive learning is the acquisition of knowledge and skills by mental or cognitive processes. In
a broader sense, cognitivism deals with learner’s aptitudes, capacity to learn and learning styles, which are further explained later in the chapter.

Unlike behaviourism, the cognitivist approaches focus on the learning process and how knowledge is internally represented by the brain thus argues that ‘black box’ of the mind should be opened and understood. In the classroom settings, cognitivism relies on both teacher and learner where the teacher provides content and leads learning while learner takes responsibility for internalising the material presented by the teacher. In his adaptive model of learning, Piaget presented the concepts of **assimilation** (the adaption of new material to an existing system) and **accommodation** (the adjustment of existing structures to the new material) and argued that these two processes complement each other (Piaget, 1972). Piaget further emphasised that the process of cognitive development is the result of a series of related assimilations and accommodations and learners constantly reconstruct their understanding of the world. This concept of Piaget is very close to the concept of **constructivism**, which also emphasises on the role of individual learner in constructing his/her own view of the material, and what helps with that.

The revolutionary work of Piaget was inspired by several other researchers such as Seymour Papert and Robert Davis who had huge impact on the constructivist movement in the U.S. Papert viewed computers as a tool that should be controlled by children and its open architecture would allow them to construct their own knowledge. Papert conceived the **Microworlds** environment (which was developed using **LOGO** programming language) for children to explore and construct their knowledge. **Turtle Geometry** is an example of the original Microworlds that is still used in the teaching of programming languages today. On the other hand, Davis believed that computers should control and guide the children to construct their own knowledge. Davis conceived the **Plato** project which led to the development of educational games and authoring tools such as **Hypercard**, **Hyperstudio**, **Director**, and **Authorware**. The evolution of such technological innovations lead to the introduction of Hypertext and authoring tools such as **HTML**, **Flash** and **QuickTime** (Gillani, 2003).
2.2.3 Constructivism

Constructivism advocates that learning is an active process of constructing one’s perspective of the world, depending on prior knowledge (Bruner, 1966). In the constructivist view, learning is not just rote memorising of information that has been transmitted passively from an information source but considered as an active, rational and self-regulatory process (Wang, 2008). The constructivist approach sees learning from two main perspectives: personal and social.

2.2.3.1 Personal constructivism

Personal constructivism can be explained through Piaget’s concept of knowledge assimilation and accommodation (Piaget, 1950, 1972), which emphasise more on how mind constructs knowledge instead of individual’s interaction with the environment. Thus personal constructivism is the process of adjusting our mental models to accommodate new experiences. In this view, the teacher provides students with a conducive learning environment, and supports and guides to make sense of the world for themselves (Elliott, 2009; Zumbach, Schmitt, Reimann, & Starkloff, 2006). In addition, the teacher must understand the mental models that students use to perceive the world and the assumptions they make to support those models (Brooks & Brooks, 1999). In today’s classroom settings, where learning is largely supported through technology, teachers should address learners’ personal characteristics while incorporating technology as an instructional methodology. However, a review of the current e-learning literature reveals that there is less research available that sought out student’s perceptions and experiences of e-learning (Wang, 2008). It also indicates that students’ learning attitude or personality traits is one of the important factors that influence their participation in e-learning (Berge, 2005; Crabtree, 2003; E. B. Kim & Schniederjans, 2004). Baird and Fisher, in their study of utilising new digital media for today’s learners suggested that today’s academics should be able to integrate new technologies as a tool to support learning by understanding the unique learning styles of the learners (Baird & Fisher, 2005). Similarly, Bonk and Zhang suggested that learners in the online environments want learning that is responsive to their preferred styles of learning (Bonk & Zhang, 2006). Keeping these recommendations in mind, this thesis
aims at addressing learners’ personal characteristics while integrating Web 2.0 technologies in unit teaching. The next section presents an overview of individual learning styles and some prominent learning style theories / models. A discussion on matching / mismatching of learning styles with instructional preferences is also presented.

Learning styles

Because of the multitude of learning style theories and authors, there is no fix term for learning style. Some authors interchangeably use the terms learning styles and cognitive styles. Others use terms like modality preferences, learning preferences, learning strategies or information processing styles (Wolf, 2007). Several authors have presented their views on learning styles. Dunn and Dunn defined learning style as “... the way in which each learner begins to concentrate on, process, and retain new and difficult information” (Dunn & Dunn, 1993). Keefe defined learning styles as “characteristic cognitive, effective, and psychological behaviours that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment” (Keefe, 1979). However, we stick to a simpler definition from Sadler-Smith, which considers learning style as “a distinctive and habitual manner of acquiring knowledge, skills or attitudes through study or experience” (Sadler-Smith, 1996). Few other terms are also frequently used in the learning styles literature such as: learning style dimension (Felder & Silverman, 1998) which refers to a cluster of conceptually related learning style elements; and, instructional / learning preferences which is favouring of one particular mode of teaching over another (Sadler-Smith, 1996).

In an attempt to provide a framework for the growing number of different learning styles theories, Curry conceived the Onion model and suggested that learning styles theories can be generally categorised into three different layers, with each layer representing a particular construct (Curry, 1983) as shown in Figure 2.1. The outmost layer of the Onion model represents instructional preferences; the middle layer represents learning styles; and the inner layer, the onion’s core, consists of cognitive personality elements.
Based on the above categorisation, different learning style theories/models can be placed in each of these layers. For example, Curry placed the Dunn & Dunn model (Dunn & Dunn, 1993) in the outermost layer (instructional preferences), which is considered as the least stable layer. Dunn & Dunn model identifies learning style elements in five categories: environmental; sociological; emotional; physiological; and, psychological (Dunn, Griggs, Olsen, Beasley, & Gorman, 1995). Several instruments and adaptations of this model can be found in the learning style literature: Felder and Silverman’s index of learning styles (ILS) is one of them. Partially based on the work of Carl Jung (1933) and Kolb (1984), the cognitive or information processing perspective of the Felder and Silverman model was developed in 1988 to address the needs of engineering and science education in general. This model was subsequently used by Felder and Soloman in 1991 to develop a questionnaire-based assessment known as Felder-Soloman’s Index of Learning Styles (ILS). This ILS measures learning styles on four bi-polar dimensions related to the preference for the type of information perceived (sensory to intuitive); the modality by which that sensory information is most effectively perceived (visual to verbal); the manner in which it is processed (active to reflective); and, the manner in which a learner progresses toward understanding (sequential to global) (Felder & Silverman, 1998). This model is relatively new but very popular, comprehensive and is considered reliable in measuring individual’s learning
styles (Felder, 2005; Zywno, 2003). It has been used in a number of learning styles studies, especially in engineering, IT and science education thus deemed suitable for this thesis to collect learning styles data of our IT students (Chapter 4).

The second layer (information processing style) of the Onion model may contain Kolb’s experiential learning theory / model (Kolb, 1984). Kolb categorised learners as convergers, divergers, accommodators and assimilators. Similarly, the Honey and Mumford model (Honey & Mumford, 1982) can also be placed into the second layer. This model categorises learners as active, reflective, theorists and pragmatists.

The third and the innermost layer (cognitive personality style) may contain elements like field dependent - field independent; adaptive - innovative; or the wholist - analytical and verbaliser - imager dimensions of cognitive styles (Sadler-Smith & Riding, 1999). In this thesis, we use adaptive - innovative dimensions of cognitive styles to examine the effect of students’ cognitive styles on user acceptance of blogs and podcasts (Chapter 5) since adaptive - innovative dimensions of cognitive styles have shown a significant effect on user performance and decision making in a number of previous academic studies. In addition to the above mentioned learning styles, some other learning style dimensions can also been found in the learning styles literature. For example: McCarthy’s 4 MAT System which classifies learners as imaginative, analytical, common sense and dynamic (McCarthy, 1987); and, Gregorc’s Mediation Ability Model which perceives learning style dimensions as: concrete sequential, abstract sequential, abstract random and concrete random (Gregorc, 1984). However, we will concentrate only on Felder’s learning style dimensions and adaptive-innovative cognitive style dimensions in this thesis which will be further elaborated in Chapters 4 and 5 respectively.

Smith and Riding, in their study of cognitive styles and instructional preferences, provided support to the Onion model and found that the innermost layer (cognitive style) is the most stable or fixed layer that affects the outer layers (Sadler-Smith & Riding, 1999). They further confirmed that cognitive style is a fundamental construct with considerable impact on various forms of behaviours. It is also observed that significant differences exist between individuals in terms of their instructional
preferences. For example, Sabry and Baldwin, in their study of exploring Web-based interactions of undergraduate students possessing varying learning styles reported that learners had different perceptions for different types of Web-based interactions (Sabry & Baldwin, 2003). Similarly, Butler et al. compared students’ learning styles with their online teaching preferences and reported strong preferences for asynchronous interactions (Butler & Pinto-Zipp, 2006). However, it is also noted in the literature review that the effect of such differences on learner’s attitudes, motivation and performance has not been investigated well in the literature (Sadler-Smith & Riding, 1999). We address this problem by analysing the effect of students’ cognitive styles on their use intentions for various Web 2.0 technologies (Chapters 5). The effect of students’ learning styles along with the treatment of specific instructional preferences on students’ performance has also been observed (Chapter 4).

Matching / mismatching learning styles with instructional preferences

A review of the learning styles literature suggests that conflicting arguments exist about matching or mismatching learning styles with instructional preferences. For example, Hodges and Evans examined the effect of three instructional methods ((1) tapes, lectures, and discussion; (2) maps, slides, and games; and, (3) a combined approach) on two groups of 12 students each with highly visual / spatial and highly verbal / analytical learners respectively (Hodges & Evans, 1983). All students were exposed to the three methods sequentially over three lectures. Their findings suggest that the visual / spatial learners performed better with a matched instructional approach but no significant difference was found for the verbal / analytical learners. Similarly, in a study about comparing effects of different media (text and text plus pictures) in computer based tutorials, Riding and Douglas found that the visual learners doubled their scores when matched, whereas verbal learners achieved similar scores under both conditions (Riding & Douglas, 1993). Researchers who support the idea of mismatching learning styles with instructional preferences argue that this may be more useful. For example, Harris et al. found no significant differences when they matched two versions of e-learning environments with active and reflective learners. Similarly, Dekeyser found that visual learners interacted less frequently with graphical material as compared to verbal learners (Dekeyser, 2001). However, Allinson and Hayes in their meta analysis of 20
studies confirmed that thirteen of them provided support for the hypothesis that matching instructional strategies with learning styles will have a positive impact on learning performance (Allinson & Hayes, 1996). This thesis follows the similar approach by matching students’ learning styles with their preferences for Web 2.0 technologies in order to integrate Web 2.0 technologies in unit teaching. The impact of this approach on students’ academic performance is also observed, as discussed in Chapter 4.

2.2.3.2 Social constructivism

Social constructivism, which is dominated by the work of Lev Vygotsky, focuses on the social nature of learning. Vygotsky’s famous theory of proximal development zones argues that the concepts which students cannot understand on their own are easy to master with the assistance of adults or peers who are more advanced (Vygotsky, 1978). The theory asserts that people learn better together, in environments where they can bounce ideas off each other and draw on each other’s experience (L. Harris, 2007). Particularly in the social constructivist approaches, learning is conceptualised as involving the use of a variety of teaching techniques (Keefe, 1979; Salomon, 1997), tools and technologies (Lim & Chai, 2003; Wertsch, 1998) by participants (teachers and learners). Vygotsky’s social theory has tremendous implications for education and the Web which involves a community of mentors in a collaborative environment (Gillani, 2003).

The personal and social constructivist approaches discussed above seem to be relevant for e-learning studies because e-learning involves online activities by teachers and students mediated by the use of technologies. Such activities help students construct their knowledge via personal discovery and share their experiences with peers and teachers (Wang, 2008). For example, Jonassen et al. applied the personal constructivist approach to the design of a technological learning environment (Jonassen, Mayes, & McAleese, 1993). Similarly, in a 12 month action research study about analysing the relationship between pedagogy and technology, Dorit recommended that it is important to integrate the relevant technology and constructivist pedagogy in e-learning environments. Dorit further argued that “…if elements of technology and pedagogy can
be seen as mutually supportive and interdependent, then it should be possible to construct new meanings about teaching online that is integrative and serves to bring about a bridging of the gap between pedagogy and teaching” (Dorit, 2004). The e-learning literature also provides some specific evidences that social theories of learning are essential for the understanding of e-learning (Russel, 2008; Schrire, 2004). For example, Salmon applied social constructive approach to develop a five-stage model of the facilitation and support required for learning through online discussion (Salmon, 2000).

Keeping in line with these recommendations, this thesis adopts the personal constructivist approach in terms of analysing the effects of students’ learning styles on their preferences of using Web 2.0 technologies. The social constructivist approach, on the other hand, will be used as a basis for incorporating Web 2.0 technologies in an academic environment. However, before we talk about the role of technology or Web-based technology in the practice of e-learning, it is important to formally define e-learning and discuss its key ingredients.

### 2.3 Definition of e-learning

As defined earlier in Chapter 1, “e-learning is the delivery of training and learning using means of electronic media, such as computers, Internet or intranet” (Tastle, et al., 2005). Three basic ingredients of e-learning constitute: content and instructional methods; ways of delivering content and methods; and, achievement of personal and organisational goals. These ingredients are also referred as the what, how and why elements of e-learning respectively (Clark & Mayer, 2008). Studies show that technology, instructor characteristics and student characteristics are responsible for the effectiveness of online delivery or e-learning (C. Dillon & Gunawardena, 1995; Leidner & Jarvenpaa, 1995). Rosenberg also described three basic features of any e-learning environment as that:

1. it should be networked;
2. it should be accessible via a standard Web browser on a standard personal computer; and,
3. it should extend the traditional paradigms of training (Rosenberg, 2001).

It is reasonable to infer from the above discussion that technology, the Web, and the learners’ personal characteristics are vital for any successful e-learning implementation. This thesis addresses this crucial issue by integrating some prominent Web 2.0 technologies in unit teaching based on students’ learning styles and instructional preferences as well as examining their key determinants and user acceptance in higher education settings with particular focus on IT education.

2.4 The role of (Web) technology in e-learning

The use of information and communication technologies (ICT) has been well documented in the e-learning literature (Castells, 1996; Gilbert, 1997). Web-based learning right from the very start has provided learning experiences that are flexible, open, and distributed. These features later gave rise to several terms like flexible delivery (Rigmor & Rosmery, 1996), distributed learning (Lea & Nicoll, 2002), online education (Weller, 2002), cyber teaching (Partee, 2002), and several others (L. Harris, 2007).

The use of ICT as a learning space has revolutionised the higher education. Learning in such spaces is no longer confined to class-room boundaries; it is taking place any time and any where. Flexibility is seen as the key to further development in higher education, and flexibility requires technology (Collis & Moonen, 2001). To address this notion of flexibility, universities are now offering individual courses or even complete degree programs using the Web technology. Many studies have pointed out the role of Web as a provider of new learning spaces where students can expand their understanding and challenge themselves (Barak & Rafaeli, 2004; Jang, 2006). Thus ICT have empowered learners with any-time any-where access to knowledge and educational resources; media rich course materials in constructivist formats; authentic, engaging and real world
assessment tasks; and, more time for reflection and critical analysis, all of which are important life-long learning skills (J. Williams & Goldberg, 2005).

A careful look at some recent studies suggests that the uptake of e-learning is generally growing (M. Bell, et al., 2002; HEFCE, 2006; Hodgson, 2002; OECD, 2005). For example, a survey of US undergraduate students in 2006 found that on average they spent 23 hours a week using technologies (Katz, 2006). Studies in Australia, New Zealand and the UK indicated Web-based learning as a dominant mode in higher education (Marshall, 2005). An Australian study in 2005 found that nearly 95% students had Web access at home and 78% considered themselves expert in using computers (Krause, et al., 2005). Therefore, there is clear evidence that students from Australia and the rest of the world are comfortable and anticipate the usage of online technologies as a major part of their study (Russel, 2008). The growth of the Web and associated technologies has broadened the horizons for e-learning. IDP Australia projects that, by 2025, there will be 159 million learners worldwide while 87 million will be located in Asia. Similarly, a study from Merrill Lynch reports that online providers of higher education can expect to capture a big portion of this growth in student numbers – around 45 million learners. Multiplying this number by the average price of tuition fee (approximately US$4,800), the global market for online higher education will be roughly US$216 billion 15 years from now (J. Williams & Goldberg, 2005). These figures highlight the potential of Web-based applications in the growth of e-learning market thus reiterate the need to tap enormous power of the Web in the best possible way. However, it should be kept in mind that the opportunities presented via new technologies are coupled with challenges such as: how to accommodate the diversified range and requirements of student population; how learners manage, strive and thrive in this information era with huge amounts of information available; to what extent the use of technology is useful and to what extent these tools should be encouraged; and, how to make correct selection decisions for specific learning tasks (Webster & Murphy, 2008). Moreover, there are concerns about student perceptions and experiences of e-learning with less research available on the topic. These concerns include: factors that influence student participation in e-learning activities and the use of technology; student’s personal technical knowledge and skills; and, perceptions of usefulness of e-learning (Wang, 2008). Another important factor is the changing nature of the current...
Web users, which are sometimes called digital natives, net generation, n-gens or millennials as they approach work, learning and play in new ways (Oblinger, 2003; Oblinger & Oblinger, 2005). Thus, it is also important to address the unique learning styles (also referred as the ‘Always On’ learning style (Baird & Fisher, 2005)) of this net generation who are entering into colleges and universities with more knowledge and expertise of communication technologies than their lecturers. Finally, although constructive approaches emphasise on the practice of student-centred or learner-centred learning, this concept is more than just adopting for various learning styles, it is rather providing control of learning itself into the hands of learner (O’Neill & McMahon, 2005). In the words of Downes: “The new Internet user may not vote, but that is only because the vote is irrelevant when you govern yourself” (Downes, 2005). However, the freedom that today’s Web users enjoy is the result of several movements and issues we have seen in the recent years, such as: open-source software, creative commons licenses and open access to scholarly resources. These movements lead to the conversion of the Web from an information exchange medium to a platform, in which content is created, shared, remixed, repurposed, and passed along (Downes, 2005). This version of the Web, which is collectively know as Web 2.0 or the Read / Write Web, is very close to the idea of the original Web developer, Tim Berners-Lee, as a collaborative medium where people meet and read and write (Richardson, 2006). The next section discusses what Web 2.0 is and how it has affected the Web users in general and educational community in particular. A discussion about some selected Web 2.0 technologies and their key features that demonstrate the Web 2.0 concepts / principles, is also presented followed by the pros and cons of their academic use. The possible challenges of using Web 2.0 technologies in higher education are also discussed.

### 2.5 Web 2.0

Many different terminologies are used to explain the phenomenon of Web 2.0, such as social software, social technologies, emerging technologies, or read / write Web. Although there is no clear definition of Web 2.0, it is considered as “a perceived second generation of Web-based interactions, applications and communities” (Duffy, 2008). To get a clearer understanding of the Web 2.0 phenomenon, it is best to look at the criteria
that these technologies or applications exhibit. The term Web 2.0 was officially coined in 2003 during a conference brainstorming session between *O'Reilly Media* and *MediaLive International* (Anderson, 2007). Tim O’Reilly, the founder of the O’Reilly Media company himself drafted seven principles in his famous article that distinguish Web 2.0 applications from their predecessors (O'Reilly, 2005), and listed them as:

1. the Web as a platform;  
2. harnessing collective intelligence;  
3. data is the next Intel inside;  
4. end of the software release cycle;  
5. lightweight programming models;  
6. software above the level of a single device; and,  
7. rich user experience

![Web 2.0 Meme Map](image)

Figure 2.2: Meme Map of Web 2.0 (adopted from (O'Reilly, 2005))
The applications or technologies that follow some or all of the above principles fall into the Web 2.0 category. In the words of O’Reilly: “Web 2.0 can be visualised as a set of (above mentioned) principles and practices that tie together a veritable solar system of sites that demonstrates some or all of those principles, at a variable distance from that core”. He added that “…the above distinction was very important because the ‘meme of Web 2.0’ was becoming so widespread that companies had started pasting it on as a marketing buzz-word’. The ‘meme map’ of Web 2.0 which was developed during the brainstorming session of O’Reilly conference is shown in Figure 2.2. The technologies (like blogs, wikis, podcasts, tagging, del.icio.us, rich user experiences, etc) shown in this figure fulfil some or all of the Web 2.0 principles mentioned above.

Web 2.0 is also considered as the most common term used for the movement of the Web from ‘push’ technology to interactive technology (Davidi, 2007). This shift is evident from publisher-generated content to user-generated content; from individual storing of bookmarks to online collective storing of bookmarks; from category based information storage and retrieval by experts to tag (label) based information storage and retrieval by the community; from information consumption to information creation and active participation by users (Kloos, 2006). Thus the real power of Web 2.0 lies in its ability to facilitate easy collaboration among individuals or groups of people and sharing of knowledge and information. In the words of Acurio and Utkovic, “Web 2.0 is more user-centred than the regular Web” (Acurio & Utkovic, 2008).

More recently, Web 2.0 has also become a buzz-word in education and wider circle which has transformed the way people have used the Internet, from passive to active users (Cleary, 2008). There is a wide variety of Web 2.0 technologies, software and services that demonstrate the foundations of the Web 2.0 concept and they are already being used to a certain extent in education (Anderson, 2007). These include blogs, wikis, multimedia sharing services, content syndication, podcasting, content tagging services and multi-user virtual environments. With the creation of such applications, the Web has been transformed into a fully interactive space allowing any user to collaborate, create, publish, subscribe, and share information (Asmus, et al., 2005). The next section presents details of some prominent Web 2.0 applications, namely: blogs, social bookmarks, podcasts and multi-user virtual environments, and their key features.
that demonstrate the Web 2.0 principles. An overview of their academic usage is also presented along with the possible challenges encountered during their class-room implementations. Needless to say that these four services are not the only services that can be labelled as Web 2.0 services. A plethora of other Web 2.0 applications are also available such as: wikis (wikipedia), instant messengers (MSN, Yahoo messenger), discussion forums, RSS (automatic syndication), social networking websites (Orkut), flickr, del.icio.us, YouTube, micro-blogging services (Twitter) and several others. However, not every service will be reviewed in this thesis. Rather, the focus will be on the above mentioned four services which are more commonly used in higher education settings and have been investigated as part of this thesis.

2.5.1 Web-logs (blogs)

The term Web-log, or blog, was coined by Jorn Barger in 1997 and it refers to “a type of Website, usually maintained by an individual with regular entries of commentary, description of events, or other material such as graphics or video”\(^1\). The blog entries or ‘posts’ are arranged in reverse chronological order with the most recent first. Most blogs also allow visitors to add comments below a blog post. A typical blog functions like an online journal and may contain text, images, and even search facilities and links to other blogs, Web pages, and media. Each blog post can be ‘tagged’\(^2\) with few keywords, which allows finding other posts from the same author that uses the same tag(s). ‘Linking’ in blogs is also an important aspect as it helps in the retrieval and referencing of information on different blogs (Anderson, 2007). Blog software also facilitates ‘syndication’\(^3\) of blog entries through RSS (Really Simple Syndication) or other feeds to be available for other software. The network of more or less interconnected blogs is called Blogsphere, which expresses the sense of a whole world of bloggers operating in their environment (Anderson, 2007; Kolbitsch & Maurer, 2006). Some popular blogging services or software are Wordpress, Blogger, LiveJournal and some well known blog search services are Technorati, Blogsearch.

\(^1\) http://en.wikipedia.org/wiki/Blog
\(^2\) Tag is a keyword or term assigned to a piece of information, which helps to describe an item and allows it to be found again by browsing or searching.
\(^3\) Web syndication is the process of making a portion of a Web site available to other sites or individual subscribers.
Gnosh and Icerocket. Some recent reports suggest that more and more people are using content creation services or blogs (Lenhart, Madden, Smith, & Macgill, 2007). At the time of this writing, Technorati has tracked 133 million blogs worldwide as compared to 44 million in 2006. Blog is one of the key services that demonstrate the foundations of the Web 2.0 concept as it allows people not only to write together but also to publish their own thoughts. This posting and commenting enable bloggers to communicate with their audience and enhance interaction, which further give rise to the formation of communities of people with similar interests (Kloos, 2006). Blogs can also be used for structuring of thoughts and reflection on interesting topics. A typical blog page is shown in Figure 2.3.

![Screenshot of a sample blog page](image)

**Figure 2.3: A screenshot of a sample blog page**

Blogging has received an increased attention in both professional and academic circles as it becomes more prevalent (Rainie, 2005). Some of the prominent academic blogs are: Weblogs at Harvard Law; MBA blog at Brisbane Graduate School of Business; Blogging at University of Maryland, and many others (J. B. Williams & Jacobs, 2004).
Anne Davis, on her educational blog\(^4\), provides a detailed list of potential uses of blogs in the classroom environment. To name a few are: demonstration of good student work; communication with parents; setting up of a reflective journal-type blog; creation of literature circle; linking to other classes somewhere in the world; distributing results of student surveys; and, discussion of class activities.

Farmer et al. reported some pros and cons of academic blogging in their study. For instance, enhanced levels of subject understanding; learning from experts in the blog network; and, the ability to categorise and manage learning content in a personalised manner, were reported as some positive aspects of students’ experience with blogs (Farmer & Bartlett-Bragg, 2005). However, difficulty with learning new software formats; identifying and establishing networks; feelings of uncertainty in regard to writing publicly; and, motivation to post regularly were the negative aspects of blogging. Similarly, in a study about communities of the Web 2.0 practice, Kloos reported improvement in writing skills; convenience of readable and searchable reports; and, creation of shared repository as benefits of academic blogging while the inability of blogs to allow direct reactions due to its asynchronous nature; the lack of media richness due to its text-based nature; and the messy structure of multiple reactions on a single post were reported as potential drawbacks (Kloos, 2006). It is clear from the above discussion that blogs can be useful in academic settings but needs to be deployed with careful planning, clear objectives, and student-centred approach. Baird and Fisher, in their study of utilising social networking technologies for the new generation of users, suggest that blogs are well suited for education because they allow individuals to self-publish their thoughts and reflections while participating in a collective environment (Baird & Fisher, 2005). They further suggest that blogs help create an environment for knowledge transfer and are excellent for project-based learning thus valued in student-centred or constructivist learning environments. Therefore, keeping in mind the inherent Web 2.0 features of blogs and their relevance with the student-centred approach, this thesis attempts to further explore this technology by implementing a blog in unit teaching, details of which are presented in *Chapter 4*. It is important to mention here that the useful hints by Anne Davis mentioned above were also given due consideration while setting up the unit blog.

\(^4\) [http://anne.teachesme.com/2004/10/05/]
Despite the above mentioned benefits, the literature on academic usage of blogs provides some conflicting reports. The studies which support blog usage in academia suggest that: blogs successfully contributed to students’ online engagement (Lin, et al., 2006); helped students share their learning experiences and express their thoughts to the instructor and peers through course blogs (Maag, 2005); and, sparked reflective learning and satisfaction among students (Dickey, 2004). On the other hand, some studies highlight the drawbacks of using blogs. For example, many blog sites were claimed to be abandoned soon after their creation (Arnold, 2008); or found to be unproductive in terms of interactivity among students (Divitini, et al., 2005). Thus, it is important to know what motivates participants to use blogs and what measures can be taken to increase blog usage in academic settings. This thesis addresses this issue by exploring significant determinants of blog usage and examining their effect on user acceptance of blogs as explained in Chapters 5 and 6.

2.5.2 Social bookmarks

Social bookmarking is the practice of saving bookmarks to a public Web site and ‘tagging’ them with keywords (Lomas, 2005). Wikipedia defines social bookmarking “as a method for Internet users to store, organise, search, and manage bookmarks of Web pages on the Internet, typically in the form of tags” (Wikipedia, 2010). Tagging is an important aspect of social bookmarking and is used to identify what a piece of information is about, what exactly it is, to whom it belongs, to refine categories, to identify characteristics, and to organise tasks (Golder & Huberman, 2007). However, the flexibility of tagging sometimes gives rise to confusions as no fixed conventions or standards are followed across various social bookmarking services, which lead to repeated, ambiguous and misleading information. ‘Tag cloud’ is another term relevant to social bookmarking or the tagging phenomena, which refers to a group of tags from a number of different users. This group of tags collates information about the frequency with which particular tags are used and helps users finding others who share common interests (Anderson, 2007). Social bookmarking helps in creating, sharing, organising, and distributing online resources / information, which demonstrates the foundations of

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3 Tagging is the process of saving links with one or more keywords that describe it.
several Web 2.0 principles such as ‘harnessing collective intelligence’, ‘data as the next Intel inside’, and ‘Web as a platform’. Such a process of collaborative work to spontaneously categorise information in a non-hierarchical manner is known as *folksonomy* (Baird & Fisher, 2005). By aggregating the results of folksonomy, it is possible to see how additional value can be created (Anderson, 2007). Some of the well known social bookmarking services are *del.icio.us, furl, cansnotea*, and *CiteULike*, the latter being used for the academic research purpose\(^6\). A sample social bookmarks page is shown in *Figure 2.4*.

![A screenshot of a sample social bookmarks page](image)

**Figure 2.4: A screenshot of a sample social bookmarks page**

The social bookmarking systems allow several common features. For instance, they allow users to:

- create and share personal collections of bookmarks;
- use tags to classify bookmarks; and,
- browse collections of bookmarks of other users (Kloos, 2006)

\(^6\) *CiteULike* is a free service to help academics to store, organise and share the academic papers they are reading.
Social bookmarking in academic settings allows quick and easy access to online resources and provides an insider’s guide to information and references (Asmus, et al., 2005). Social bookmarking can also help learners reducing high-cognitive load activities of searching and evaluating information and building a pool of online resources covering a particular topic. Baird and Fisher argue that social bookmarking has its roots in constructivist learning theories as it allows users to chunk, scaffold and organise information in a format that best suits the user (Baird & Fisher, 2005). Despite its limited usage in education, social bookmarking has the potential to provide opportunities for collaboration, knowledge generation, knowledge sharing, and virtual community formation, when deployed in academic settings. Therefore, keeping in mind the inherent Web 2.0 features of social bookmarking and its relevance with the student-centred approach, this thesis attempts to further explore this technology by implementing a unit bookmarks page as explained in Chapter 4.

### 2.5.3 Podcasts

Podcasting is a method of distributing audio or video recordings via the Internet, allowing users to subscribe to a feed of new files (Walton, Childs, & Blenkinsopp, 2005). The word podcast is a combination of two words: 'ipod'; and, 'broadcast'. The basic ingredients for creating a simple podcast consist of: a digital audio recorder to create MP3 file; some space on a server to host the file; and an RSS feed to distribute the file to users through automatic subscription. Podcasting is popular among people from all different walks of life with all sorts of interests including education (Richardson, 2006).

Research suggests that the use of academic podcasting is on the rise (Brittain, Glowacki, Van Ittersum, & Johnson, 2006; Ractham & Zhang, 2006; Richardson, 2006). A well-known resource for educational podcasting is the Education Podcast Network Website\(^8\), which was first started in 2005. It contains a directory of educational podcasts from teachers and students and links to suggested classroom uses of podcasts based on various class levels and subjects. Another notable example of academic podcasting is

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7 An MP3 player from Apple Inc.
8 http://epnweb.org/
the ‘Duke iPod First-Year Experience Project’ in which Duke University used iPods as a: course content dissemination tool; classroom recording tool; field recording tool; study support tool; and, file storage and file transfer tool (Belanger, 2005). One of the key benefits of academic podcasting is the any-time any-where availability of lecture recordings (audio or video) for students. Podcast also provides an innovative and exciting way for people to improve communication, collaboration and social networking (Ractham & Zhang, 2006) and is reported as a more flexible and effective method than traditional methods of using Websites and printed handouts (Chan & Lee, 2005). Richardson calls podcasting as a form of radio broadcasting that has now become a reality for vast majority of educational institutions that can not afford radio stations. Richardson further describes several ways of using podcasts in classroom settings, which include:

- class recordings of important parts of the subjects;
- recordings of practice lessons for language classes which students from any part of the world could listen to at any time;
- oral histories or historical events for social studies classes;
- student narrations of lab experiments for science classes; and,
- weekly recitals for music classes (Richardson, 2006).

All these features of podcasts demonstrate the foundations of several Web 2.0 principles such as the use of Web as a platform and rich user experiences which further suggest that like blogs and social bookmarks, podcasts have the potential to complement unit delivery using a variety of mediums, which makes it a valuable Web 2.0 technology that needs to be explored further in this thesis, as explained in Chapters 4, 5 and 6.

2.5.4 Multi-user virtual environments (MUVEs)

Before defining multi-user virtual environments it is important to know what a virtual environment is? Virtual environments are defined as “immersive imaginary spaces supporting sensory feedback, visualised through computer simulations and designed for their users to inhabit, collaborate and interact” (Bogdanovych, 2007). One of the most popular kinds of virtual environments available today is the class of 3-D multi-user
virtual environments (MUVEs), which allow interactivity and collaboration for multiple users. Thus we define 3-D MUVEs as “multi-user virtual worlds designed using the metaphor of architecture and visualised using three dimensional computer graphics” (Bogdanovych, 2007). MUVEs are typically designed to replicate the real world situations, with real world rules such as gravity, topography, locomotion, real-time actions, and communication. Immersion in MUVEs is supported by representing users as ‘avatars’, which is defined as “one, two or three-dimensional representation of humanoids” (Sherman & Craig, 2003). More recently, businesses have turned to MUVEs to reach wider audience. These immersive environments allow collaboration among colleagues through virtual spaces; enable companies to get public opinion or feedback about their forthcoming products through their virtual showrooms; and, allow academic institutions and teachers to meet their educational requirements through virtual campuses (Atlas, 2008). Some prominent MUVEs that exist today are There, Active Worlds, World of Warcraft, Everquest, Habbo Hotel, Entropia, The Sims, and Second Life. In order to explore the academic usage of MUVEs in this thesis, we choose Second Life (SL) because of the several reasons. First of all, SL is considered as the most widely used non-game based MUVE to date, with approximately 88,000 logged in users at any given time of the day and more than 18 million users world wide as of November 2009. According to SL’s recent economic report, its users have collectively spent a total of 126 million hours and 3.14 billion voice minutes during the second quarter of 2009 alone (Linden, 2009). These figures reflect the mammoth user base and wide spread popularity of SL. Secondly, SL has been largely adopted by the educational community and at least 300 universities around the world today offer courses or conduct research in SL (Kirriemuir, 2008). In addition, during the course of this doctoral research, Swinburne University of Technology (the host institution) was in the process of establishing its virtual campus in SL (as shown in Figure 2.5) and the academics at Swinburne were keen to know what motivates people to use virtual worlds in higher educational setting, so that they could enhance its usage when they deliver future courses on their virtual campus.
SL is a 3-D MUVE launched by Linden Labs in 2003. SL is a world solely created by its inhabitants, called ‘residents’. Residents have the opportunities to create their digital proxies called ‘avatars’ and design their clothing, hair colour, dresses and even appearances (Coffman & Klinger, 2007). Avatars can walk, run, or even fly in the virtual environment. They can converse with other avatars using a variety of communication channels including text, images, gestures or even voice. Residents can move or ‘teleport’\(^9\) from one location to another. SL provides opportunities for its residents to create virtual goods and services to sell, buy and trade to other residents using *Linden dollars* (Jennings & Collins, 2007), the currency that runs the SL economy which can be exchanged against real US dollars. SL provides enormous opportunities to imitate real world situations and rich user experiences (a key Web 2.0 principle) in a virtual environment. To name a few: reincarnation of ancient architecture and civilisations (R. Harrison, 2009); advertising and selling of real life commodities (Lui, Piccoli, & Ives, 2007); live music concerts (BBC, 2006; Walsh, 2006); experiencing complex medical procedures discounting dangerous outcomes (Thompson & Hagstrom, 2006).

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\(^9\) Teleport is the process of moving avatars from one place to another simultaneously without passing through the intervening space.
3-D MUVEs like SL offer a variety of potential benefits for educational usage including: collaboration and communication; engagement; conducting activities in a risk-free environment; alternative space for instruction and tasks; and visualisation of difficult content (Eschenbrenner, Nah, & Keng, 2009). Russel suggests that MUVEs such as SL offer the possibility of immersive online social learning, using technologies that many young people are already familiar with from online chat-rooms and games (Russel, 2008). The immersive nature of SL allows for exploration and interaction with elements in the world. These social interactions create emotional aspects with other residents as well as the environment itself (Nummenmaa, 2007). All these features of SL demonstrate the foundations of several Web 2.0 principles listed in Section 2.5.

Educators have explored several uses of MUVEs such as developing models, simulations, historical recreations, scientific collaborations, and role-playing scenarios tied to academic content. Similarly, teachers in higher education have also found SL a convenient place to conduct online classes, conferences, presentations, and meetings with students (Richter, Anderson-Inman, & Frisbee, 2007). However, in order to explore the teaching and learning potential of SL, it is important to explore the significant determinants of SL usage as explained in Chapter 7. Richter et al. identified at least five different types of learner engagement that are possible in SL: experiential; diagnostic; demonstrative; role-play; and, constructivist (Richter, et al., 2007). Similarly, Coffman et al. pointed out that SL has the potential to be a useful educational tool for teaching and learning by using a constructivist approach (Coffman & Klinger, 2007). Therefore, like blogs, social bookmarks and podcast, SL will also facilitate the student-centred learning following a constructive approach. However, the use of technology in academic settings is coupled with challenges. In the next section, we highlight some of the challenges that educators face while implementing Web 2.0 technologies in their class-room settings.
2.5.5 Challenges in the use of Web 2.0 technologies in higher education

There are growing concerns regarding the gaps between the popularity and usefulness of Web 2.0 technologies in educational environments as well as their low penetration rates. These concerns give rise to further questions like: how to encourage more people to use Web 2.0 technologies for teaching and learning; how to motivate experienced users to use these technologies more frequently or make full use of them. This thesis attempts to fill such gaps by examining the key determinants of technology acceptance of some prominent Web 2.0 technologies such as blogs, podcasts, and Second Life thus suggesting ways of improving their academic usage. Also, because of the infancy of Web 2.0 technologies, very few studies are available that explain the user acceptance of Web 2.0 technologies (Anderson, 2007; Becerra & Stutts, 2008), especially in the educational contexts.

In the next section, we discuss technology acceptance which is an important field of IS research and deals with the adoption or continued use of new technologies in various scenarios and organisations. A commentary of some prominent technology acceptance theories / models is presented with key emphasis on Davis’s technology acceptance model (TAM) (Davis, et al., 1989), which is used as a theoretical baseline for examining user acceptance of Web 2.0 technologies in this thesis. A detailed discussion on the rationale behind choosing TAM is also presented.

2.6 Theory of technology acceptance

Information technology (IT) is a multi-billion industry today as companies and institutions spend a major part of their budgets on IT procurements and installations. IT is also playing a pivotal role in academia, more specifically in universities, as higher education institutions strive to maintain goals of quality, effectiveness and efficiency (Petrides, 2000). However, there are growing concerns over the extent to which such expenditures have produced benefits to business and academia or at least if IT has actually been accepted by its intended users? Thus user acceptance is an important concept as it is vital for the success of any IT implementation in any organisation or
institution. Since e-learning is the delivery of teaching and learning through ICT, therefore the concept of user acceptance is vital for this research as we are particularly interested in exploring the usage of today’s most influential technology, the Web or the associated Web 2.0 technologies to be precise.

User acceptance is defined as “the demonstrable willingness within a user group to employ IT for the tasks it is designed to support” (A. Dillon & Morris, 1996). It is considered as an outcome variable in a psychological process while making decision about a technology. It has been viewed as pivotal in determining the success or failure of any IS project (Venkatesh, Morris, Davis, & Davis, 2003) and holds special importance for the practitioners or researchers of IT and IS disciplines. Researchers have studied a range of issues related to the concept of acceptance and developed several theoretical models and frameworks that explain or predict a person’s decision to accept a new technology (Chakraborty, et al., 2008). In the next sections, we briefly explain some of the prominent technology acceptance theories or models, such as Innovation Diffusion Theory (IDT), Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB) and Technology Acceptance Model (TAM). However, more emphasis will be given on TAM and the rationale behind choosing TAM for this research.

### 2.6.1 Innovation Diffusion Theory (IDT)

Innovation Diffusion Theory (IDT) has been in use since 1950s and its primary goal is to provide a way in which technological innovation moves from the stage of invention to widespread use. IDT has been applied both at individual (Rogers, 1983) and organisational (Zaltman, Duncan, & Holbek, 1973) levels of analyses. It is not exclusive to IT acceptance; rather it provides a general framework for analysing acceptance in a global scope. According to Rogers, there are five major characteristics (as shown in Figure 2.6) that affect individual’s adoption of innovation (Rogers, 2003), namely:

1. *relative advantage* (the degree to which a technology supersedes other available tools);
2. *compatibility* (the extent to which a technology is consistent with the social practices and users’ past experiences);

3. *complexity* (the degree of ease of use. It is negatively related to its rate of adoption);

4. *trialability* (the opportunity to try an innovation before committing to use it); and,

5. *observability* (the extent to which the technology’s outputs are visible to others).

Studies of innovation diffusion suggest that technologies affording the above characteristics will be more extensively diffused as compared to those with opposite characteristics (A. Dillon & Morris, 1996; Rogers, 1983). Dillon and Morris also suggest that IDT mostly deals with the area of innovation characteristics and provides little explanation towards explaining the concept of user acceptance. They further emphasise that the factors that determine user acceptance of IT are better explained in the theories of social and cognitive psychology and sociology.
2.6.2 Theory of Reasoned Action (TRA)

The theory of reasoned action (TRA), developed by Martin Fishbein and Icek Ajzen in 1980, posits that attitudes and subjective norms jointly influence the behavioural intention which in turn drives individual behaviour (use or rejection of technology) (Ajzen & Fishbein, 1980), as shown in Figure 2.7. The attitude here refers to the attitude towards behaviour and is defined as the previous attitude of a person toward performing that behaviour. Subjective norm is the person’s perception that most people who are important to him / her think he / she should or should not perform the behaviour in question (Fishbein & Ajzen, 1975). Behavioural intention is the cognitive representation of a person’s readiness to perform a given behaviour and considered to be the immediate antecedent of individual behaviour (Napaporn, 2007). Because TRA separates behavioural intention from behaviour, it also discusses the factors that limit the influence of attitudes (or behavioural intention) on behaviour.

![Diagram](image)

**Figure 2.7: Theory of Reasoned Action (TRA)**

The TRA model has been applied in a variety of situations and organisations to analyse the determinants of human behaviour and is considered robust with a strong predictive ability (A. Dillon & Morris, 1996). However, the technology acceptance literature does point out some limitations for the use of TRA, which often include the confounding relationship between attitudes and norms and the attributes that limit the freedom of act while making a decision. These limitations lead to the development of some extended acceptance models such as Theory of Planned Behaviour (TPB), Technology Acceptance Model (TAM), or TAM2 as discussed next.
2.6.3 Theory of Planned Behaviour (TPB)

Theory of planned behaviour (TPB) is a descendant of TRA presented by Ajzen in 1985, which adds a third independent determinant of intention, *perceived behavioural control* (PBC), to the TRA model along with attitude and subjective norm, as shown in Figure 2.8. PBC refers to people’s perception of their ability to perform a given behaviour, thus resembles close to Bandura’s concept of *self-efficacy* (Bandura, 1991). Because of PBC, TPB is considered to be more general than TRA.

![Figure 2.8: Theory of Planned Behaviour (TPB)](image)

To identify and model the specific antecedents of TPB determinants (attitude, subjective norm and perceived behavioural control) toward the use of IT, Taylor and Todd presented a Decomposed Theory of Planned Behaviour (DTPB) in 1995. DTPB proposed *perceived usefulness, perceived ease-of-use* and *compatibility* as antecedents of attitude; *peer influence* and *superior’s influence* as antecedents of subjective norm; and, *self-efficacy, resource-facilitating conditions,* and *technology-facilitating conditions* as antecedents of perceived behavioural control (Shirley Taylor & Peter Todd, 1995), as shown in Figure 2.9. DTPB is considered to have more capability in explaining usage behaviour although it is less parsimonious when compared with original TPB (Napaporn, 2007).
2.6.4 Technology Acceptance Model (TAM)

While TRA is a more generic model applicable to many areas, a number of IT specific models have been derived from TRA. Of particular importance is the Technology Acceptance Model (TAM), originally developed by Davis and his colleagues (Davis, et al., 1989) in order to explain or predict individuals’ acceptance of computer based systems in various scenarios and organisational contexts. TAM posits that “user perceptions of usefulness and ease-of-use determine attitudes towards using the system or technology while individual’s attitude is hypothesised to influence the behavioural intention to use a technology, which in turn leads to actual use”. Perceived usefulness is also influenced by perceived ease-of-use because the easier the system (technology) is, the more useful it can be (Venkatesh & Davis, 2000). TAM also theorised that the effects of external variables on intentions to use are mediated by perceived usefulness and ease-of-use. In validating TAM, Davis et al. found a stronger relationship between perceived usefulness and behavioural intentions to use than perceived ease-of-use and behavioural intention, the later being largely mediated through perceived usefulness (Davis, et al., 1989). TAM differs with TRA in several respects: first, it drops subjective norm from the model; second, TAM proposes a direct path from perceived usefulness to intention; and third, TAM shows a direct effect of perceived ease-of-use on perceived usefulness, as shown in Figure 2.10.

Figure 2.9: Decomposed Theory of Planned Behaviour (DTPB)
TAM is the mostly used and cited model in the IS research. It has been considered as being both robust and parsimonious for predicting user acceptance of a variety of new technologies (Raaij & Schepers, 2008) and because it incorporates findings accumulated from over a decade, it may be especially well suited for modelling IT acceptance (Davis, et al., 1989).

In the follow-up studies of TAM, Venkatesh and Davis proposed some changes to the original TAM and came up with TAM2 in the year 2000. In the extended model (TAM2), the attitude component was dropped and perceived technology characteristics directly influenced the individual’s intention to use the technology. Subjective norm was re-introduced in the model (Venkatesh & Davis, 2000). TAM2 is shown in Figure 2.11.
2.6.5 Rationale behind using TAM in this thesis

A comparison of TAM with other acceptance models provides significant support for TAM in predicting user acceptance of new technologies. For example, a comparison of TAM with TRA confirms that TAM is parsimonious and easy to apply across various research scenarios (Davis, et al., 1989). Similarly, a comparison of TAM and TPB reveals that both models predicted intention to use quite well but TAM was slightly better from an empirical view (Mathieson, 1991). Mathieson also found that TAM predicted intention to use a spreadsheet package better than alternative models. In a comparison of TAM and DTPB, Taylor and Todd suggested that although DTPB performed slightly better than TAM but TAM was preferred in situations where the main goal was to predict IT usage (Shirley Taylor & Peter Todd, 1995). Both TAM and TAM2 have been successfully validated for a wide range of computer technologies and systems such as word processors, e-mail, spreadsheets (Lederer, Maupin, Sena, & Zhuang, 2000). TAM has also been used to predict the user acceptance of Web (Napaporn, 2007); Web-browsers (Morris & Dillon, 1997); Web-based learning systems (Halawi & McCarthy, 2007); and, multimedia learning systems (Saade, et al., 2007). Several extensions or modifications to the original TAM have also emerged in recent years. For example, Saade & Bahli extended original TAM to include cognitive absorption in order to explain the acceptance of Web-based learning systems (Saade & Bahli, 2005); Moon & Kim introduced playfulness as a new determinant in TAM to reflect user’s intrinsic belief in WWW acceptance (Moon & Kim, 2001); and, Shih combined TAM and information behaviour model to develop an extended TAM for the Web usage behaviour (Shih, 2004). However, a review of academic literature reveals that very little work has been done on user acceptance of Web 2.0, especially in the educational context. For example, in an attempt to study the continued usage of blogs, Hsu & Lin extended the TRA model by involving technology acceptance, knowledge sharing and social influence constructs and reported that ease-of-use, enjoyment and knowledge sharing were positively related to attitude toward blogging while social factors and attitude influenced continued usage intentions of blogs (C. Hsu & Lin, 2008). However the study was not conducted in the academic domain. In an another study, Gribbins collected data about some TAM constructs (perceived usefulness, attitude toward podcasting and behavioural intention to use podcasting) and reported
students’ positive behaviour towards usefulness of podcasting (Gribbins, 2007). However, the effectiveness of podcasting was questioned by the majority of students and the study lacked in providing a concrete structural model to explain the user acceptance of academic podcasting. Shin & Kim proposed and evaluated an extended TAM including perceived synchronicity, perceived involvement and perceived enjoyment to measure the usage intentions toward *Cyworld* (a social networking Website) (Shin & Kim, 2008). The proposed model was supported by the data and the constructs used in the model were helpful in explaining the Web 2.0 specific factors. These findings would also help analysing user acceptance of Web 2.0 technologies in this thesis. Similarly, Chen et al. proposed a model to predict user acceptance of Second Life in education but empirical evaluation of the proposed model was not reported in their paper (X. F. Chen, Slau, & Nah, 2008).

Another important issue raised in some recent studies is the inability of traditional technology acceptance approaches in explaining the user acceptance of today’s highly interactive, multi-user and entertainment oriented social technologies like social networking Websites, multi-player online games and multi-user virtual environments (Heijden, 2004; C. L. Hsu & Lu, 2004; Koufaris, 2002). As this thesis deals with the usage of Web 2.0 technologies which largely constitute the above mentioned characteristics, it is vital to validate the traditional approaches of technology acceptance in the case of Web 2.0 technologies. At the same time, this thesis also attempts to explore significant determinants of Web 2.0 technology usage.

### 2.7 Summary

This chapter formed the theoretical base of the thesis. The chapter started with a discussion on three prominent learning theories: behaviourism; cognitivism; and, constructivism as well as their implications on the design of e-learning environments. With a student-centred approach in mind, we discussed about various learning styles theories / models as well as the concept of matching / mismatching learning styles with instructional preferences. The discussion on personal and social constructivist approaches helped in understanding the concept of e-learning, which further helped in
highlighting the role of Web technologies in e-learning. We then explained the notion of Web 2.0 and the key features of Web 2.0 technologies that demonstrate the Web 2.0 concepts / principles. An overview of some selected Web 2.0 technologies was also presented along with their potential academic usage. We highlighted the challenges that educator face while deploying Web 2.0 technologies, which further led to the discussion on technology acceptance and associated technology acceptance theories / models. Most importantly, the chapter helped in highlighting the problem areas and the gaps found in the literature about integration and user acceptance of Web 2.0 technologies in higher education and how this thesis would address those issues.
Chapter 3: Methodology

3 Methodology

This chapter discusses the methodologies to carry out the research in question. A brief overview of qualitative and quantitative research methodologies is presented along with associated investigation approaches. The adopted methodologies are discussed which were chosen based on the nature of research questions, the extent of control required over behavioural events and the focus on contemporary versus historical events. The rationale behind choosing the ‘case study’ approach to address the initial research inquiry in this thesis and a ‘survey study’ approach to address the later stages of the research is also presented. The chapter also details the design of the case studies and the survey studies reported in this thesis including data planning, ethics clearance, questionnaire development and analyses of results.

3.1 Approaches to the investigation

The classic research-process model involves: starting with a theory; generating hypotheses; testing the hypotheses; and, interpreting results (Vanderstoep & Johnston, 2009). Thus research process is cyclic in nature as shown in Figure 3.1.

![Figure 3.1: Classic research process model (adopted from (Vanderstoep & Johnston, 2009))](image)
After understanding the basic research model, the next important step is the selection of an approach to investigate the research topic. In general, most research approaches are best understood as being either qualitative or quantitative in nature, where qualitative research produces textual or narrative descriptions while quantitative research specifies numerical assignment to the phenomena under study. The qualitative research helps in the identification of major themes and is generally recommended during the earlier phases of the study. Qualitative data is rich but time consuming and less able to be generalised. The common strategies used in the qualitative research are ethnography, case study, textual analysis, and applied research. The quantitative research, on the other hand, deals with specific questions or hypotheses and is generally recommended in the later phases of the study. Quantitative data is in the form of numbers and statistics and is more efficient but lacks contextual detail. The common strategies used in quantitative research are surveys and experiments (Vanderstoep & Johnston, 2009).

The selection of appropriate research strategy is always a challenging task. However, researchers recommend considering three important conditions while selecting a research strategy (Vanderstoep & Johnston, 2009; Yin, 2003):

1. the type of research question posed (who, what, where, how, and why)
2. the extent of control a researcher has over actual behavioural events, and
3. the degree of focus on contemporary as opposed to historical events.

Yin recommends using appropriate research strategy based on the above three conditions (Yin, 2003). For example, the case study approach suits best when the research questions focus on how and why type of questions; when researcher requires no control over behavioural events; and, when research is focused on contemporary events only. Similarly, survey is the best choice to address what type of questions; with no control required over behavioural events; and when the focus is on contemporary events only. Therefore, to figure out the best research approach for this thesis, we need to look back at our research objectives presented earlier in Chapter 1 (Section 1.3):

1. how to effectively integrate Web 2.0 technologies in higher education?
2. **what are the key determinants of user acceptance of Web 2.0 technologies in higher education?**

The first objective addresses the *how* type of questions investigated during the earlier phases of this thesis and is exploratory in nature in terms of integrating Web 2.0 technologies in a higher education environment using a student-centred approach. In addition, this situation does not require researcher’s control over students’ opinion about their personal and instructional preferences. Finally, the context of this research is contemporary in terms of analysing the emerging Web 2.0 technologies in current educational settings. Therefore, *case study* approach suits best to address our first research objective.

The second research objective has been investigated during the later phases of this research and addresses *what* type of questions in terms of exploring key determinants of Web 2.0 usage and examining their user acceptance in a higher education environment, using well tested theories and models. This situation does not require researcher’s control over students’ opinion about their usage behaviours toward Web 2.0 technologies and the context is contemporary in nature as well. Therefore, the *survey* approach is best suited to address our second research objective.

### 3.2 Case study design

A case study is an empirical inquiry that investigates a contemporary set of events, over which the researcher has little or no control. But every empirical research needs a research design, a logical sequence that connects the empirical data to a study’s initial research questions and ultimately to its conclusions (Yin, 2003). A research design is considered as a blue print of research, dealing with the problems of: study questions; data relevance; data collection; and, results analyses (Philliber, Schwab, & Samsloss, 1980). For case studies, five components of research design are especially important (Yin, 2003):

1. a study’s question(s);
2. its proposition(s);
3. its unit(s) of analysis;
4. the logic linking of the data to the proposition(s); and
5. the criteria for interpreting the findings

The study question is already discussed above, i.e., *how to effectively integrate Web 2.0 technologies in higher education*. The study proposition highlights the things that should be examined within the scope of the study. In our case, it is the use of *student-centred* learning approach to integrate Web 2.0 technologies in unit teaching. The third component of research design is the unit of analysis or the *case* itself, that is, the use of Web 2.0 technologies within higher education. The fourth and fifth components of research design deal with the data analysis steps in case studies. This has been done using various statistical analyses techniques such as: correlations among students’ learning styles and technology preferences; cross tabulation of learning styles and technology preferences against gender and age variables; and, comparison of academic performances among various learner types.

A single case study approach is considered useful to test a well formulated theory or when the case represents a unique case. However, our initial research inquiry is exploratory in nature and directed towards the discovery of Web 2.0 technologies and their effectiveness in academic settings. Therefore a multi-case approach has been adopted, which is aimed at providing more compelling evidence and is considered a robust approach (Herriott & Firestone, 1983). The analytical conclusions arising from the two case studies are considered more powerful than those coming from a single case study (Yin, 2003). Therefore, a ‘two-study’ approach has been adopted in this thesis in order to analyse the usage of Web 2.0 technologies based on student-centred learning approach. The *two-study* approach will allow for direct replication of the findings. However, the context of the two case studies will be different: the first case study will be conducted in an introductory Web programming unit while the second case study in an advanced Web programming unit at a later stage (after completion of the first case study). The study participants will be the undergraduate and postgraduate students from Faculty of ICT, Swinburne University of Technology in Melbourne, Australia. The first case study aims at exploring students’ initial understanding of Web 2.0 technologies and
highlighting the impact of students’ personality traits and technology preferences on the use of Web 2.0 technologies. It also aims at analysing the impact of matching learning styles with technology preferences as well as academic performances. The second case study aims at replicating the findings of the first case study in order to achieve our first research objective.

3.2.1 Case study plan

Both case studies required a study plan and a similar approach was adopted in both studies. This included data planning, an application for ethics clearance, questionnaire development and a set of results generated from the case study analyses.

3.2.1.1 Data planning

To maintain consistency among both case studies and to ensure the relevance of case study results to the overall research goals, a data planning exercise was undertaken in both case studies. This included: collecting and analysing students’ learning styles and technology preferences data at the start of the semester; integrating a combination of Web 2.0 technologies in unit teaching based on the above analyses; collecting students’ feedback at the end of the semester; and finally, analysing students’ academic performances. More details on data planning are available in Chapter 4.

3.2.1.2 Ethics clearance

An ethics clearance was obtained from Swinburne’s Human Research Ethics Committee (HREC) before conducting the case studies. An online form of disclosure with informed consent was provided to the participants at the start of each case study with the following details:

- project title
- contact details of investigators
- a brief introduction of the case study including expected outcomes
• participation details
• participants’ rights and interests
• participants’ privacy and confidentiality
• participants’ consent to take part in the case study

In accordance with the ethical requirement, participants were informed that their participation in the study will be on voluntary basis without obligation and will have no effect on their class activities or academic performance. In addition, they were assured that complete anonymity will be observed and individuals will not be identified in research publications. A copy of the complete *Form of Disclosure and Informed Consent* along with the evidence (email) of ethics clearance is available in *Appendix A*. At the completion of the case studies, a final report was also submitted to *HREC*.

### 3.2.1.3 Questionnaire development

The data for both case studies were collected through online questionnaires posted on University’s secure Web servers. The online questionnaires were developed using *PHP* scripting language and database connectivity was provided through *MySQL* database management system. The questionnaires were targeted towards undergraduate and postgraduate students of Faculty of ICT at Swinburne University of Technology (SUT). Students of an introductory Web programming unit were invited to take part in the study through emails and *Blackboard* (the default learning management system used at Swinburne) announcements.

For each questionnaire, a different number of questions were established, reviewed, revised and finally adopted. The learning style questionnaire was adopted from Felder-Soloman’s *Index of Learning Styles (ILS)* (Felder & Soloman, 1993) while the technology preference and feedback questionnaires were prepared by the author in consultation with the field experts. Both case studies were comprised of three questionnaires: two at the start of the semester and one at the end. The first questionnaire aimed at collecting students’ learning styles data while the second aimed at collecting students’ demographic details, current experience with the Web and Web 2.0 technologies and their preferences of Web 2.0 technologies against various
academic activities. Students were also asked to rate their agreement level on the use of various Web 2.0 technologies in the academic environment. The second questionnaire also included some open-ended questions like suggestions on potential academic uses of Web 2.0 technologies. The third questionnaire was conducted at the end of the semester to collect students’ feedback on the incorporated Web 2.0 technologies. It also aimed at collecting the frequency of technology usage and students’ opinion on the pros and cons of incorporated technologies. Some open-ended questions were also included like suggestions for improvement in the current study as well as ideas for future improvements. Full copies of the three questionnaires are available in Appendices B, C and D respectively.

3.2.1.4 Case study results

Data analysis consists of examining, categorising, tabulating, testing or otherwise recombining both qualitative and quantitative evidence to address the initial propositions of the study (Yin, 2003). Most of these techniques have been employed in this thesis in order to develop a deeper understanding of the Web 2.0 technology usage in academia.

A number of interesting results were extracted as a result of the above analyses which include relationships within various learning styles, relationships within various technology preferences, cross relationships between learning styles and technology preferences, and analysis of academic performances among various learner types. These findings helped in selecting and later integrating a combination of Web 2.0 technologies in a unit teaching. More data analyses were performed to compare the outcomes of the two case studies. Complete details of the two case studies are available in Chapter 4.

3.3 Survey design

A survey is a study that collects information by asking people questions (Shoemaker & McCombs, 2003). The information collected (data) is generally numerical and suitable for statistical analysis. Surveys are often used to address what type of research questions. They also help to profile a target audience by determining what proportion of
Chapter 3: Methodology

audience has certain behaviours, behavioural intentions, and attitudes and whether specific determinants predict behaviours at a statistically significant level (CDCynergy, 2007). Therefore, to fulfil the second objective of this thesis, that is, exploring key determinants of user acceptance of Web 2.0 technologies in higher education, a survey approach was adopted. In particular, we were interested in analysing usage intentions of some prominent Web 2.0 technologies and the key determinants of such usage.

One of the key decisions in overall survey planning is the design - who will be surveyed, over what period, and how many times? There are three basic survey designs: the panel study, the trend study, and the cross-sectional survey (Gunter, 2002). The first two designs involve investigation with the same individuals at more than one point in time (longitudinal studies) and are used to study the change in population rather than change in individuals. The third approach, cross-sectional survey, involves investigation with the respondents only once and the data provides a snapshot of the population at the time of the study (Shoemaker & McCombs, 2003). Shoemaker et al. further explain that cross-sectional surveys can also describe the characteristics of respondents’ attitudes and behaviours at a given point of time. As our second research objective was mainly focused on exploring individual’s usage of Web 2.0 technologies in higher education, a cross-sectional approach deemed suitable.

3.3.1 Survey plan

To fulfil the second objective of the research, two separate cross-sectional surveys were conducted, the first survey helped in examining the key determinants and user acceptance of blogs and podcasts in higher education context while the second survey was targeted towards Second Life. The survey plan consisted of data planning, ethics clearance, instrument design and analysis of survey results.

3.3.1.1 Data planning

The two survey plans differed in terms of survey respondents. The first survey involved undergraduate and postgraduate students of a Web Programming unit in the Faculty of
ICT at SUT. The second survey involved students, teachers, researchers and academic managers with some experience in Second Life and the data was gathered from a variety of resources (SL’s educational forums, advertising within SL, personal invitations, and SL’s list serves). More details on data planning of the two surveys are available in Chapters 5 and 7 respectively.

3.3.1.2 Ethics clearance

The ethics clearance to conduct the two surveys was obtained using a similar approach as discussed earlier in the case study approach (Section 3.2.1.2). A copy of the complete ‘Form of Disclosure and Consent Information Statement’ along with the evidence (email) of ethics clearance is available in Appendix E. A final report was also submitted to HREC at the completion of the survey studies.

3.3.1.3 Instrument design

Instrument design refers to the writing and formatting of survey questionnaire (Shoemaker & McCombs, 2003). The questions used in the instrument should represent operational definitions for the variables under study. It is also important to specify the research hypotheses prior to data collection and to provide explicit theoretical definitions for all concepts in the hypotheses. A similar approach has been adopted in this thesis while developing the research hypotheses, as explained in Chapters 5, 6 and 7. Researchers of quantitative research methodologies recommend several guidelines for instrument design (Buckingham & Saunders, 2004; Shoemaker & McCombs, 2003; Stasko, 1997; Walonick, 2004), such as:

- use of simple language
- use of specific / concrete questions
- use of one dimensional questions
- use of proper layout
- avoiding long questions
- avoiding biased or leading questions
• avoiding ambiguous wordings

The majority of constructs used in this thesis came from well established theories of information systems, psychology, consumer behaviour, marketing, and communication and repeatedly validated for internal reliability and validity. However, the above recommendations were also given due consideration while designing the Web version of the survey questionnaires.

3.3.1.4 Survey results

Survey researchers have become adept at multivariate statistical techniques that help rule out alternative explanations for a relationship by statistically controlling for the effects of other variables on the observed relationship (Shoemaker & McCombs, 2003). Multiple regression is one such technique that enables researchers to find out the extent to which one variable (criterion or dependent) changes as more than one other variable (predictor or independent) changes (Gunter, 2002). Structural Equation Modelling (SEM) is another multivariate analysis technique, which is considered more general and very powerful as compared to multiple regression, factor analyses, path analysis or other multivariate techniques (StatSoft, 2008). SEM allows for more flexible assumptions, provides use of confirmatory factor analysis to reduce measurement error, graphical interface modelling, the ability to test models with multiple dependents, the ability to model error terms, and the ability to handle difficult data (Garson, 2009). The SEM process involves validating the measurement model and fitting the structural model. LISREL, AMOS and EQ are three popular approaches for performing the SEM analysis. An alternate approach for specifying structural equation models is Partial Least Squares (PLS), which is often better suited for data exploration. PLS is a variance based latent variable SEM technique, which uses an estimation approach that places minimal demands on sample size and residual distributions (Chin, 1998b). Studies show that the PLS approach is more suitable for prediction as compared to other approaches like LISREL, AMOS and EQ, because it assumes that all the measured variance in the study will be explained (Saade & Bahli, 2005). The PLS approach has also been used in a huge number of technology acceptance studies such as: (Raaij & Schepers, 2008);
(Saade & Bahli, 2005); and, (Mun & Hwang, 2003) hence deemed suitable for our research.

The findings of PLS analyses helped in validating the research hypotheses and the structural models proposed in this thesis as well as predicting the key determinants of Web 2.0 usage under consideration.

3.4 Summary

The research methodologies for this thesis were selected based on the nature of the research objectives presented in Chapter 1, the extent of control required over behavioural events and the focus on contemporary versus historical events. The case study approach was chosen to address the first objective of this research because: the focus was on the how type of questions in terms of exploring appropriate ways of integrating Web 2.0 technologies in a higher education setting; the investigation was done during the earlier stages of the research; the research was exploratory in nature in terms of matching students’ learning styles with instructional preferences of Web 2.0 technologies; the situation did not require researcher’s control over participants’ opinion about their learning styles and instructional preferences; and, the context of the research was contemporary in nature in terms of analysing emerging Web 2.0 technologies in the current higher education settings.

A two-case study approach was adopted: the first case study helped in integrating a combination of Web 2.0 technologies based on the match between students’ learning styles and technology preferences. The second (follow-up) case study replicated the results of the first case study. Details of the two case studies are available in Chapter 4.

To address the second objective of the research, the survey approach was adopted because: the focus was on the what type of research questions in terms of highlighting the key determinants of Web 2.0 usage in academic context; the investigation was done during the later phases of the research; the information collected to investigate the research objective was quantitative in nature; the situation did not require researcher’s
control over participants’ opinion about their usage behaviours toward Web 2.0 technologies; and, the context of the research was contemporary in nature in terms of analysing emerging Web 2.0 technologies in the current higher education settings.

Two separate survey studies were conducted: the first survey helped in validating the proposed research hypotheses / model to examine user acceptance of blogs and podcast and the second survey helped in examining the user acceptance of Second Life. The two surveys also helped in predicting key determinants of the technology usage. Findings of the two surveys further helped in drafting implications for researchers, teachers and practitioners of Web 2.0 technologies. Details of the two survey studies are available in Chapters 5, 6 and 7.
4 Integrating Web 2.0 Technologies in Unit Teaching

This chapter presents details of the two case studies which were carried out to integrate Web 2.0 technologies in unit teaching based on a student-centred approach. Although a detailed review of Web-based technologies and student-centred approach has already been presented in Chapter 2, this Chapter recaps the educational uses of Web 2.0 technologies and the importance of matching student learning styles with instructional preferences. The chapter explains the methodology adopted in the case studies which comprises: collection and analyses of students’ learning styles and technology preference data; integration of Web 2.0 technologies in unit teaching based on the match between students’ learning styles and technology preferences; collection and analyses of students’ feedback on the usage of incorporated technologies; and finally, reporting of key findings of the case studies. The chapter also presents a detailed discussion on the major contributions of the two case studies and implications for lecturers, researchers and practitioners of Web 2.0 technologies along with some limitations. The research work presented in this chapter has been reported in the following publications: (Saeed & Yang, 2008a); (Saeed & Yang, 2008b); and (Saeed, et al., 2009b).

4.1 Educational uses of Web 2.0 technologies

The growth of Web-based applications has made Web an important educational medium (Siau, Nah, & Teng, 2002). Notably, with the creation of emerging Web 2.0 technologies such as blogs, wikis, instant messengers, podcasts, vodcasts and social bookmarks, the Web has been transformed into a fully interactive space allowing any user to collaborate, create, publish, subscribe, and share information (Asmus, et al., 2005). The adoption level of Web 2.0 technologies is on the rise in academic settings (Long, 2006; Pulichino, 2006) and several examples of integrating these technologies in
unit teaching can be found (Augar, Raitman, & Zhou, 2004; Belanger, 2005; Farmer & Bartlett-Bragg, 2005; Lu, Chiu, Day, Ong, & Hsu, 2006). These emerging technologies have the potential to create engaging learning environments and students and lecturers alike are achieving many of the benefits of these interactions (Baird & Fisher, 2005). For example, blogs facilitate the publication of knowledge, opportunities for subsequent reflection and analysis, and help learners understand the relational and contextual basis of knowledge, knowledge construction and meaning making (Ferdig & Trammell, 2004). Similarly, wikis facilitate the creation of shared knowledge, dissemination of information, and group interaction (Augar, et al., 2004). Instant messengers promote collaborative learning and team work and promote interaction and communication skills (Lu, et al., 2006). Social bookmarks allow quick and easy access to online resources and provide an ‘insiders’ guide to information and references (Asmus, et al., 2005). Podcasts provide an innovative and exciting ways for people to improve communication, collaboration and social networking (Racatham & Zhang, 2006) and can be used for dissemination of knowledge, broadcasting news to staff and students, supplementing class materials, and guest lecture presentations (H. Harris & Park, 2008).

The above mentioned features are key learning elements and make Web 2.0 appropriate for educational use. However, to help students achieve the full cognitive development, lecturers need to integrate these technologies with the end-user experience and learning styles (Baird & Fisher, 2005). A review of the current learning literature suggests that limited understanding of students’ characteristics is a major obstacle in the practice of Web-based instruction and that success of Web-based educational programs depends considerably on students’ acceptance or usage of these technologies (Raaij & Schepers, 2008; Yang & Tsai, 2008). Therefore it is important to investigate the learning styles and instructional preferences of the current generation of students in order to effectively integrate Web 2.0 technologies into our units. This chapter addresses these issues by integrating a combination of Web 2.0 technologies in unit teaching based on the match between students’ learning styles and technology preferences.
4.2 Learning styles and instructional preferences

Learning style is a distinctive and habitual manner of acquiring knowledge, skills or attitudes through study or experience while learning preference is favouring of one particular mode of teaching over another (Sadler-Smith, 1996). Understanding the relationship between learning styles and instructional strategies holds great promise for enhancing students’ perceptions of their own learning (Claxton & Murrell, 1987). As learning styles provide information about individual differences in learning preferences they can suggest how instruction can be best designed to support learning preferences (Akdemir & Koszalka, 2008). A review of learning theory literature suggests that learning styles and instructional preferences influence the effectiveness with which individuals learn and the match between these two is advantageous for academic achievements (Huey Wen Chou & Wang, 1999; Lipsky, 1989; Smith & Dalton, 2005). Therefore, a first hand knowledge of students’ learning styles and instructional preferences can help lecturers choose the right methods of instruction for the right audience.

The knowledge of students’ learning styles is also important in order to design and manage different Web-based environments or other learning materials in various subject areas (Akkoyunlu & Soylu, 2008). For example, Sun et al. (using Kolb’s learning style inventory) reported that ‘accommodators’ made the most significant achievements in their study of analysing learning effect among different learning styles in a Web-based lab for science students (Sun, Lin, & Yu, 2008). Similarly, Chou found clear differences in the performance and learning preferences of ‘field-dependent’ and ‘field-independent’ students in their study of comparing learning styles with training methods (H. W. Chou, 2001). Butler and Pinto compared students’ learning styles with online teaching preferences and reported ‘dual’ learning style (Concrete-Random / Abstract-Sequential) as dominant with strong preferences for asynchronous interactions (Butler & Pinto-Zipp, 2006). Some previous studies also highlight the impact of learning styles on academic performance and reported that the learners with particular learning styles performed better than others (Allert, 2004; Chamillard & Karolick, 1999; Thomas, Ratcliffe, Woodbury, & Jarman, 2002).
This chapter presents details of the two case studies on matching learning styles with technology preferences of Web 2.0 technologies. The main goal of the case studies was to find optimal ways of integrating Web 2.0 technologies in unit teaching while examining the impact of learning styles on technology preferences as well as academic performance of various learner types.

4.3 Methodology

As mentioned earlier in Chapter 3, a two-case study approach was adopted to investigate effective ways of integrating Web 2.0 technologies in higher education settings. However, the context of the two case studies was different: the first case study was conducted in an introductory Web programming unit in Semester 1, 2007 while the second in an advanced Web programming unit in Semester 2, 2007. The first case study was aimed at integrating Web 2.0 technologies based on students’ learning styles and technology preferences as well as analysing academic performances of various learner types. The second case study was primarily aimed at replicating the findings of the first case study.

4.3.1 Case studies plan

Both case studies followed a similar plan and involved the following phases:

1. collecting students’ learning styles and technology preferences data, at the start of the semester.
2. analysing the above data to highlight significant relationships between students’ learning styles and technology preferences.
3. integrating a combination of Web 2.0 technologies based on the outcomes of the above analyses.
4. collecting of students’ feedback on the usage of incorporated technologies, at the end of the semester.
5. analysing students’ feedback to identify key strengths and possible shortcomings of the case studies.
4.3.2 Case studies participants

The first case study was conducted in Semester 1, 2007 with a total of 204 students in an introductory Web programming unit. The participants were studying towards the completion of Bachelors or Masters of IT degrees in the Faculty of ICT at Swinburne University of Technology. The second case study was conducted in Semester 2, 2007 with 159 students enrolled in an advanced Web programming unit from the same faculty.

4.3.3 Measurements

The data for the case studies were collected by means of online questionnaires. Learning styles data was collected using Felder-Soloman’s *Index of Learning Styles* (ILS) (Felder & Soloman, 1993). Felder’s model classifies students as: active–reflective; sensing–intuitive; visual–verbal; and sequential–global learners (Felder, 1996). The Felder-Soloman’s ILS consists of 44 questions each carrying two responses (‘a’ or ‘b’). It provides the scores (as 11A, 9A, 7A, 5A, 3A, 1A, 1B, 3B, 5B, 7B, 9B, 11B) for each of the four scales. Scores 1-3 on either side of the scales represent ‘well-balanced’ or ‘mild’ preferences, scores 5-7 represent ‘moderate’ and scores 9-11 represent ‘strong’ preferences - a total of 12 possible outcomes on each scale. Felder’s learning model deemed suitable for this study because it focuses on those aspects of learning styles that are particularly significant in engineering and IT education (Zywno & Waalen, 2002). It is also considered as one of the mostly used models to capture individual differences during the last decade (Dag & Gecer, 2009). Its free Web-based presence, ease of use, automatic reporting feature and the accompanying descriptive information provided by its authors were some other good reasons for adopting this instrument in this thesis. A number of previous studies have also confirmed the reliability of Felder-Soloman’s ILS. For example, Zywno provided support for the reliability of Felder-Soloman’s ILS for its intended purpose of identifying learning styles (Zywno, 2003). Litzinger et al. conducted a study to assess the reliability, factor structure and construct validity of Felder-Soloman’s ILS and reported that the original ILS generated data with acceptable

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10 Construct validity refers to how well a construct gauges the actual meaning of the concept it is supposed to represent.
levels (0.55 and 0.77) of internal consistency. The factor analysis and student feedback also provided strong evidence for its construct reliability (Litzinger, Lee, Wise, & Felder, 2007). The complete questionnaire is available in Appendix B.

To collect the technology preferences data, a questionnaire was prepared in consultation with the field experts. The questionnaire included some demographic questions such as participants’ age, gender, and current experience with the Web and Web 2.0 technologies. It also included questions about students’ technology preferences to perform various academic activities on a 5-point Likert scale ranging from 1 (strongly disagree) through 5 (strongly agree), along with some open-ended questions. The complete questionnaire is available in Appendix C.

### 4.4 Results of learning style and technology preference questionnaires

#### 4.4.1 Demographics

Out of 204 enrolled students in the introductory Web programming unit, 119 responded to the learning styles questionnaire with a response rate of 58.3%, including 101 (84.9%) males and 18 (15.1%) females. The majority (85.7%) was aged between 21 and 29. For technology preference questionnaire, 105 responses were received with a response rate of 51.4%, including 90 (85.7%) males and 15 (14.3%) females. Nearly 70% reported their Web usage as more than 15 hours per week, and 82.2% described ‘Study’ as the major reason of using Web, which suggests that the majority was well aware of the Web usage in academia and was familiar to some extent with the Web-based e-learning technologies.

#### 4.4.2 Learning styles frequency distribution

*Table 4.1* presents the mean and standard deviation values for each of the learning style scales. As mentioned earlier in *Section 4.3.3*, the scores between 1 and 3 on each learning style scale represent ‘well balanced’ or ‘mild’ preferences. Therefore, the
figures in Table 4.1 show that the majority of our students were ‘well-balanced’ (i.e., in the middle of two dimensions) on active - reflective, sensing - intuitive and sequential - global scales but exhibited ‘moderate’ preference for verbal dimension on the visual - verbal scale.

<table>
<thead>
<tr>
<th>Learning Style scales</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active – Reflective</td>
<td>0.73</td>
<td>4.29</td>
</tr>
<tr>
<td>Sensing – Intuitive</td>
<td>2.45</td>
<td>4.46</td>
</tr>
<tr>
<td>Visual – Verbal</td>
<td>5.80</td>
<td>4.06</td>
</tr>
<tr>
<td>Sequential – Global</td>
<td>2.16</td>
<td>3.96</td>
</tr>
</tbody>
</table>

Table 4.1: Mean and standard deviation of four learning style scales

4.4.3 Relationships within learning styles

Pearson correlation coefficient revealed two significant relationships within four learning style scales: a small positive relationship between active - reflective and visual - verbal scales (r = .191, N = 119; p < 0.5); and a similar relationship between sensing - intuitive and sequential - global scales (r = .216, N = 119; p < 0.5). These results suggest that reflective learners were correlated with verbal learners while intuitive with global learners. The strength of the above relationships was measured as follows (Pallant, 2005):

\[
\begin{align*}
    r &= .10 \text{ to } .29 \rightarrow \text{small;} \\
    r &= .30 \text{ to } .49 \rightarrow \text{moderate;} \\
    r &= .50 \text{ to } 1.0 \rightarrow \text{strong}
\end{align*}
\]

4.4.4 Relationships within technology preferences

In the technology preference questionnaire, participants were requested to rate their technology preferences against various academic activities. Besides collecting preferences for emerging Web technologies, participants were also requested to rate

\[\text{\footnotesize{11 In large samples (N>100), very small correlations may be statistically significant (Pallant, 2005)}}\]
their preferences for some conventional e-learning technologies like email and Blackboard as these were used as an integral part of unit delivery at SUT.

Pearson correlation coefficient revealed several significant relationships as shown in Table 4.2: three strong relationships; three moderate; and, two small relationships. All significant relationships were positive, i.e., the higher preference for one technology lead to the higher preference for the other. These results suggest that the learning preferences of various technologies were closely related, i.e., our students preferred to try various technologies instead of relying on one particular tool. These results were also encouraging to integrate multiple technologies in our study. It was interesting to see that none of the emerging Web technologies (blog, wiki, IM, podcast, vodcast) correlated well with any conventional technology (email or Blackboard). It is important to mention here that social bookmarking was not included in Table 4.2 as it did not correspond to any academic activity mentioned in the technology preference questionnaire (Appendix C).

\[
\begin{array}{cccccccc}
\text{Blackboard} & \text{Blog} & \text{Email} & \text{IM} & \text{Podcast} & \text{Vodcast} & \text{Wiki} \\
\hline
\text{Blackboard} & .08 & & & & & \\
\text{Blog} & & & & & & \\
\text{Email} & .51** & .05 & & & & \\
\text{IM} & .00 & .38** & .02 & & & \\
\text{Podcast} & -.04 & .29** & -.05 & .56** & & \\
\text{Vodcast} & .17 & .11 & .04 & .39** & .57** & \\
\text{Wiki} & .08 & .18 & .05 & .38** & .29** & .11 \\
\end{array}
\]

Table 4.2: Significant relationships among various technology preferences

4.4.5 Relationships between learning styles and technology preferences

To see the impact of students’ learning styles on technology preferences of various Web technologies, we combined the data for learning styles and technology preference questionnaires and obtained 89 valid responses altogether.

The correlations between four learning style scales and preferences for the above mentioned Web technologies suggests the following: active - reflective scale did not

\(^{12}\text{In Table 4.2, figures in bold represent strong relationships; figures in italic represent moderate relationships; figures in normal text represent small relationships; and, figures without asterisks represent non-significant relationships. ** Correlation is significant at the 0.01 level.}\)
reveal any significant relationship with the technology preferences; sensing - intuitive scale correlated negatively with the preference of using email \( (r = -0.12; N = 89; p < 0.5) \) but correlated positively with the preference of using blogs \( (r = 0.12; N = 89; p < 0.5) \); visual - verbal scale correlated negatively with the preference of using vodcasts \( (r = -0.16; N = 89; p < 0.5) \); and, sequential - global scale correlated negatively with the preference of using podcasts \( (r = -0.14; N = 89; p < 0.5) \). The above results imply that students with sensing learning style preferred to use email while intuitive students preferred blogs. They also suggest that students with visual learning style preferred vodcasts while sequentials preferred podcasts. We will discuss more on these results later in the chapter (Section 4.9).

### 4.4.6 Matching learning styles with technology preferences

Based on the above statistical analyses, a combination of Web based technologies is integrated in an introductory Web programming unit as follows: Since sequential, visual, sensing and intuitive learning styles correlated well with podcast, vodcast, email, and blog respectively, it prompted the use of audio and video recording of the lectures; email; and, a unit blog to facilitate the above mentioned four learner types. To match the appropriate technologies for the remaining four learner types (active, reflective, verbal and global), some assumptions were made based on the statistical analyses presented earlier in the chapter.

The first assumption was based on the fact that like intuitive learners, global learners would also prefer to use blogs because these two learner types were found to be significantly correlated (Section 4.4.3). The second assumption was based on the fact that audio recording (podcast) of lectures would suit verbal learners since verbals are characterised as those who learn best from words, written or oral (Felder, 1996). Following this argument, reflective learners would also prefer podcast because verbal and reflective styles were found to be significantly correlated (Section 4.4.3). Finally, social bookmarks were assumed to be a good match for active learners as active learners usually prefer new and innovative ways of learning (Felder & Soloman, 1993). Table 4.3 presents a summary of matching various technologies with each of the learner types.
Chapter 4: Integrating Web 2.0 Technologies in Unit Teaching

<table>
<thead>
<tr>
<th>Learning style</th>
<th>Technology preference</th>
<th>Learning style</th>
<th>Technology Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>Social bookmark</td>
<td>Reflective</td>
<td>Podcast</td>
</tr>
<tr>
<td>Sensing</td>
<td>Email</td>
<td>Intuitive</td>
<td>Blog</td>
</tr>
<tr>
<td>Visual</td>
<td>Vodcast</td>
<td>Verbal</td>
<td>Podcast</td>
</tr>
<tr>
<td>Sequential</td>
<td>Podcast</td>
<td>Global</td>
<td>Blog</td>
</tr>
</tbody>
</table>

Table 4.3: Matching learning styles with technology preferences

4.4.7 Suggestions on potential academic uses of Web 2.0 technologies

The technology preference questionnaire also included some open-ended questions that were targeted at getting students’ suggestions on potential academic uses of Web 2.0 technologies.

<table>
<thead>
<tr>
<th>Blogs / Wikis</th>
<th>Podcasts / Vodcasts</th>
<th>IM</th>
<th>Social Bookmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be used to post tutorials, guides, and unit related material</td>
<td>Casting of lectures for review at a later date</td>
<td>To ask quick questions to lecturer</td>
<td>Bookmarking of relevant sites or topics</td>
</tr>
<tr>
<td>To post definitions of commonly used terms</td>
<td>Reinforce lecture contents</td>
<td>Not a good way of communication in education</td>
<td>Sharing of information</td>
</tr>
<tr>
<td>To post supplement course material</td>
<td>Make up for missing lectures</td>
<td>Good for group discussion</td>
<td>Maintaining online collection of bookmarks</td>
</tr>
<tr>
<td>Can help create simple websites</td>
<td>Project presentations</td>
<td>Good to get instant reply and share views</td>
<td>Easy access to online resources</td>
</tr>
<tr>
<td>To present review lectures</td>
<td>Lecture Archive</td>
<td>virtual office hours</td>
<td>Sharing information with researchers</td>
</tr>
<tr>
<td>Helps in information and ideas sharing</td>
<td>Explanation of unit material</td>
<td>It is a private tool not suitable for education</td>
<td>Lets you maintain a personal collection</td>
</tr>
<tr>
<td>Class discussion from remote locations</td>
<td>Facilitate self-paced learning</td>
<td></td>
<td>Useful for assignment references</td>
</tr>
<tr>
<td>Collaborative work on programming assignments / projects</td>
<td>Any-time any-where access</td>
<td></td>
<td>Keep students update and well informed</td>
</tr>
<tr>
<td>To post student podcast presentations and photos</td>
<td>Good to recap lecture contents during holidays or before exams</td>
<td></td>
<td>Sharing and searching of bookmarks using tags</td>
</tr>
<tr>
<td>Can help making online student communities</td>
<td>Instructional videos</td>
<td></td>
<td>Gives a reflection of others approach on a particular topic</td>
</tr>
</tbody>
</table>

Table 4.4: Students’ suggestions on academic uses of emerging Web technologies
Table 4.4 lists a summary of the most common suggestions made by students about blogs, wikis, podcasts / vodcasts, IM and social bookmarks. For example: participation in class discussion from a remote location using a unit blog or creating podcast presentations for group projects, etc. Students also showed their hesitation towards using IM as an educational tool and expressed their limited experience with social bookmarks.

4.5 Integrating blog, social bookmarks and podcasts / vodcasts in an introductory Web programming unit

Based on the criteria discussed above (Sections 4.4.5 and 4.4.6), a combination of unit blog, a unit bookmarks page and audio / video (podcast / vodcast) recordings of lectures was integrated in the introductory Web programming unit. In order to avoid setting up extra blogging and social bookmarking software on the University servers, we decided to use free hosting services. For the unit blog, Blogger (http://www.blogger.com) was chosen, as it is considered a fast, reliable and well-known blogging service from Google (Bryant, 2006). To set up the unit bookmarks page, del.icio.us’ (http://del.icio.us) was chosen, a well known social bookmarking service. For the recording and delivery of lecture podcasts / vodcasts, the lecture capture facilities (Lectopia) available at Swinburne University were used.

4.5.1 Swinblog

The unit blog was set up on Blogger as ‘Swinblog’. It was aimed at getting quick feedback from students on the teaching and learning issues and enhancing collaboration among students and between students and lecturers. To achieve the first objective, a weekly minute paper was posted on Swinblog. Minute paper is considered as a way to promote meta-cognition thinking amongst students and to provide lecturers with ungraded and immediate feedback in order to assess how well and how much students have learned (Murphy & Wolff, 2005). A minute paper usually comprises two simple questions: ‘what is (are) the most significant thing(s) you have learned in this lecture’ and ‘what question(s) remain unclear in your mind’?
Students were encouraged to use minute paper to raise positive and negative aspects of the weekly lectures or any Web programming related queries. To achieve the second objective, students were encouraged to post solutions to the queries raised by fellow students on the unit blog. This was intended to help students publish their thoughts, become critical thinkers, peer mentoring, enhanced communication and collaboration, and creating a virtual community, thus improving the understanding level of the whole unit. A sample screen shot of students’ participation in Swinblog is shown in Figure 4.1. An example of peer mentoring on Swinblog: a student posting a possible solution in response to a query raised by a fellow student in the weekly minute paper.

4.5.2 Swinbookmark

The unit social bookmarks page was set up on del.icio.us as ‘Swinbookmark’ with the following aims: (1) to build a repository of Web programming related online resources with easy access to all students; and, (2) to engage students in the knowledge building and knowledge sharing process. To achieve the first objective, the teaching staff used to
post their online resources (bookmarks) relevant to the weekly topics. For easy access to the relevant bookmarks, they were grouped into topics in a similar way as they appeared in the text book.

![Image of Swinbookmark network](image)

**Figure 4.2: An example of knowledge building and knowledge sharing in Swinbookmark**

To achieve the second objective, students were strongly encouraged to maintain their own del.icio.us accounts and to post their favourite bookmarks on weekly topics. Students’ accounts were then added to the Swinbookmark’s network list, which allowed us to monitor students’ participation. On the other hand, it allowed students to see what fellow students were contributing. A sample screen shot of Swinbookmark is presented in **Figure 4.2.** An example of knowledge building and knowledge sharing process in Swinbookmark: a list of Web programming related online resources contributed by students. A list of participating students is also available in the Figure.

### 4.5.3 Lecture podcasts / vodcasts

As mentioned earlier, Swinburne’s lecture capture facilities (*Lectopia*) were used to record and publish audio and video recordings of Web programming lectures. Students
could access the recordings in three different formats: live streaming; manual download; and, automatic subscription, as shown in *Figure 4.3*. They were also able to access recordings through their *Blackboard* accounts. All lectures were recorded and published with the aim of complementing teaching and learning through podcasting.

*Figure 4.3: Podcasts / vodcasts of Web programming lectures*

### 4.6 Results of the feedback questionnaire

To get students’ feedback on the usage of incorporated technologies in the first case study, an online feedback questionnaire was used at the end of the semester. It was aimed at collecting the following information: usage frequency of the incorporated technologies; usefulness of minute paper; key benefits of using those technologies; potential shortcomings; student preferences about various media types; and, students’ overall satisfaction. A total of 88 valid responses were obtained with a response rate of 43%. A copy of the feedback questionnaire is available in *Appendix D*. 
4.6.1 Feedback on Swinblog

Usage frequency: The figures obtained from the feedback questionnaire revealed that over 40% of the respondents accessed Swinblog at least once a week and 58% published at least once. The actual entries on Swinblog’s posts matched the findings of the feedback questionnaire where nearly 40% of the class participated in the blogging activity with a total of 538 posts published in 12 weeks, an average of nearly 45 posts per week or 2.6 posts per student.

Key benefits: More than 75% of respondents liked the idea of using minute papers and posting answers to queries on Swinblog while 20% were neutral on this issue. This shows students’ interest in publishing their thoughts and willingness to participate in the peer mentoring activities. This also reflects that they liked sharing knowledge with others, participating in collaborative activities and being a part of the teaching and learning process.

Over 82% of respondents agreed that posting answers to students’ queries improved their own understanding of the unit contents while nearly 65% also agreed that students’ feedback provided through minute papers even improved lecturer’s performance in content delivery. This shows that Swinblog helped in reinforcing the lecture contents.

Nearly 67% of respondents agreed that Swinblog not only improved collaboration and communication among students but also among lecturers and students. Only 4.5% did not agree with this idea. This is another promising result which strengthens the case study outcomes. It is also worth noting that 71.6% of the respondents were overall satisfied with the use of Swinblog.

Key problems: Nearly 56% of the respondents preferred to be anonymous while 46% expressed that their identity hindered their participation on Swinblog. This shows that privacy and security were the key concerns for students when interacting on the unit blog. When asked about alternative options for Swinblog, the majority (69.3%) preferred to use either discussion board or a blog integrated within Blackboard. This is a clear indication that privacy matters when interacting on a public blog.
Suggestions for improvement: Students provided some interesting suggestions in response to the open-ended questions asked about improving the unit blog and the potential features they would like to see in future blogs. Some interesting suggestions include: better user interface; blog integrated within Blackboard; use of moderator to introduce new topics; search facility; and, threaded discussion in blogs.

4.6.2 Feedback on Swinbookmark

Usage frequency: The results of the feedback questionnaire reveals that nearly 35% of the respondents accessed Swinbookmark at least once a week and nearly 22% contributed at least one bookmark. However, the actual entries on Swinbookmark showed that only 25% of the class participated in the social bookmarking activity. Nevertheless, this small population did contribute 202 useful Web programming related online resources with an average of nearly 4 bookmarks per participant or nearly one bookmark per student in the unit. This indicates that although Swinbookmark was not very frequently used in the unit but it surely contributed well towards knowledge building and knowledge sharing.

Key benefits: Despite its low usage, over 77% of the respondents liked the idea of social bookmarking in unit teaching. More than 65% agreed that Swinbookmark improved collaboration and communication among students as well as among lecturers and students, only 4.5% did not agree with this idea. A reasonable majority (71.6%) also agreed that social bookmarking helped in creating a virtual community. Nearly 73% of the participants were overall satisfied with the use of Swinbookmark.

Key problems: As with Swinblog, privacy and security were also the key concerns for students when interacting on Swinbookmark. Nearly half of them agreed that they would prefer to be anonymous and their identity hindered their participation on Swinbookmark. These results suggest that privacy and security need to be addressed in order to increase student participation in online collaborative activities.
Suggestions for improvement: The most prominent suggestions made by students to improve Swinbookmark were: the need for detailed use instructions; and, Swinbookmark integrated within Blackboard.

4.6.3 Feedback on lecture podcasts

Usage frequency: The results of feedback questionnaire reveal that only 10.2% of the respondents never accessed lecture podcasts / vodcasts, showing that lecture recordings were abundantly used by the majority. This is also evident from the number of hits tracked in Blackboard: a total of 1064 hits were tracked for 11 lectures with an average of nearly 97 hits per lecture or 5 hits per student. These results show that podcasting was the most preferred technology and made a significant contribution in complementing the lecture contents.

Key benefits: The majority (75%) of respondents preferred to access lecture podcasts via ‘manual download’ as compared to ‘live streaming’ (21.6%) and ‘RSS feeds’ (3.4%). However, 61.4% also downloaded the lecture recordings on their portable devices (MP3 / MP4 players, iPods, PDAs, mobile phones). The majority (78.8%) preferred to use podcasts / vodcasts at home but nearly 16% used them while commuting to or from the campus. In addition, nearly 60% reported that they would prefer video recordings of the lectures as compared to audio in their future units. These results show that lecture podcasts were effectively used by the majority and supported the notion of anytime - anywhere access of lecture contents. 86.4% participants were overall satisfied with the use of lecture podcasts.

Key problems: An interesting downside of podcasting emerged as its negative impact on class attendance since 58.8% of the respondents agreed that the availability of lecture podcasts affected their class attendance. Nearly 49% also agreed that they would prefer to use podcasts at their convenient times rather than attending the lectures. This is a challenging situation which requires a proactive approach from lecturers. On one hand, they need to engage students in interactive activities to maintain class attendance. On the other hand, they need to provide alternate ways of learning in the form of lecture podcast.
Suggestions for improvement: Some interesting suggestions made by students about lecture podcasts / vodcasts were: ‘short podcasts of lecture summary for quick review’; and, ‘divide large video file into several smaller files for quick download’. Some students also complained about the poor quality of video recordings and bandwidth limitations. These suggestions were forwarded to the Lectopia staff at Swinburne for future improvements.

4.7 Analyses on academic performance

At the end of the semester after all assessments were completed for the Web programming unit, some further analyses were conducted in order to see the impact of gender, age and learning styles on students’ academic performances. We performed Chi-Square test for independence to determine whether academic performance and gender variables were related, i.e., whether males performed better than females or vice versa. Chi-Square test is a useful way to explore relationship between two categorical variables. In our case, the academic performance variable was re-coded into five categories according to the grading scheme (HD = High Distinction, D = Distinction, C = Credit, P = Pass, N = Not-Pass). Similarly, the age variable was re-coded into two categories as ‘young’ (17 – 26 years) and ‘mature’ (above 26 years) students. Table 4.5 shows the Chi-Square tests for gender and academic performance variables with Chi-Square Values, Degrees of freedom (Df) and asymptotic significance level (Asymp. Sig.). The Pearson Chi-Square Value is 8.135, with an associated significance level of 0.065. To be significant, the ‘Sig.’ value needs to be 0.05 or smaller (Pallant, 2005). In this case, the value of 0.087 is larger than the alpha value of 0.05, so we conclude that our result is not significant. This means that there is no significant difference in the overall performance of males and females.

Similarly, no differences were found in the overall performance of young and mature-age students as the Chi-Square tests for age and academic performance variables resulted in Pearson Chi-Square Value of 8.393, with an associated significance level of 0.078.
The *Chi-Square* analysis of four learning style scales and high achievers (who scored 85% or more) across various assessment components (programming assignments, multiple choice questions, and final examination) also revealed no significant differences. For example, the proportion of active learners who scored 85% or more in the overall assessment was not significantly different to that of reflective learners (*Chi-Square Value* of 0.044, with an associated significance level of 0.835). Similar results were obtained for the low or average performers in the class (*Chi-Square Value* of 0.265, with an associated significance level of 0.607). These results suggest that our teaching approach, including the use of emerging Web technologies, was not biased toward any particular learning style(s). In other words, it accommodated all learner types to achieve well-balanced academic performances.

### 4.8 Results of the second (follow-up) case study

As mentioned earlier, the second case study followed the same plan as adopted for the first case study except that the context was different, i.e., the second case study was conducted in an advanced Web programming unit in Semester 2, 2007. This is a second unit in Web programming series and most of the students in this unit also participated in the first case study. In order to address the recommendations of the first case study, few improvements were made in the follow-up study such as restricted (members only) access of unit blog and social bookmarks page. This section presents key findings of the second case study and their comparison with the first case study.
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4.8.1 Correlations within learning style scales

The correlations within four learning style scales resulted in only one new significant relationship: a moderate positive relationship between intuitive and global learning styles ($r = .453; N = 161; p < 0.01$). A similar but weaker relationship was found in the first case study along with a relationship between reflective and verbal learners. This demonstrates the need to conduct more research on the topic in order to better understand relationships between various learning styles.

4.8.2 Correlations within tools preferences

All but one (between vodcast and IM) correlations found in the first case study also appeared significant in the second case study in addition to three new relationships (in bold) as shown in Table 4.6. This shows that students’ experiences of the first case study improved their confidence toward usage of Web based technologies.

<table>
<thead>
<tr>
<th></th>
<th>Blackboard</th>
<th>Blog</th>
<th>Email</th>
<th>IM</th>
<th>Podcast</th>
<th>Vodcast</th>
<th>Wiki</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blackboard</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Blog</strong></td>
<td>-.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Email</strong></td>
<td>.97**</td>
<td>.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IM</strong></td>
<td>.01</td>
<td>.39**</td>
<td>.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Podcast</strong></td>
<td>-.09</td>
<td>.43**</td>
<td>-.07</td>
<td>.21*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vodcast</strong></td>
<td>-.10</td>
<td>.45**</td>
<td>-.08</td>
<td>.18</td>
<td>.85**</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wiki</strong></td>
<td>-.01</td>
<td>.69**</td>
<td>-.02</td>
<td>.44**</td>
<td>.39**</td>
<td>.33**</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.6: Correlations within tools preferences

4.8.3 Correlations between learning styles and tools preferences

*Pearson correlation coefficient* revealed two more significant relationships between students’ learning styles and tools preferences in addition to those obtained in the first case study: a positive correlation between reflective learners and preference of using

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13 In Table 4.6, figures in bold represent strong relationships; figures in italic represent moderate relationships; figures in plane text represent small relationships; and, figures without asterisks represent non-significant relationships. ** Correlation is significant at the 0.01 level; * Correlation is significant at the 0.5 level.
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Since reflective learners learn by thinking things through and prefer working alone (Felder, 1996) therefore blog was a good choice for them to first go through the learning and collaborative activities taking place on the unit blog and then participate on their own pace. Although verbals learn best by spoken or written information but every one learns more when information is presented both verbally and visually (Felder & Soloman, 1993) as in our case where we presented audio and video recordings of Web programming lectures. Hence podcast was also an appropriate choice for the verbal learners.

4.8.4 Integrating blog, social bookmarks and podcasts / vodcasts in advanced Web programming unit

Following the above arguments and those provided earlier in Section 4.4.6, a combination of unit blog, a unit bookmarks page and series of lecture podcasts / vodcasts was integrated in the advanced Web programming unit. The students’ feedback was also collected at the end of the semester.

4.8.5 Results of the feedback questionnaire

Feedback on unit blog: A comparison of the number of respondents who accessed unit blog in the two case studies revealed that relatively less (37%) number of respondents accessed unit blog (at least once a week) in the second case study. However, the number of posts per student improved from 58% to 64% in the second case study. Almost similar number of respondents (75%) liked the idea of using minute paper and posting answers on unit blog in both case studies. The second case study showed relatively less confidence in the unit blog for improving student understanding (75%) of and lecturers’ performance (53.2%) in delivering the unit contents. However, it showed improvement (70%) in collaboration and communication among students and lecturers. The second case study also confirmed privacy and security as major threats toward the use of unit blog as nearly 48% of the respondents preferred to be anonymous and nearly 50% felt
that their identity hindered their participation in the blogging activities. It also confirmed that the majority (70%) of respondents preferred to use other alternatives or a blog integrated within Blackboard. However a reasonable majority (63%) seemed overall satisfied with the usage of unit blog.

The above results confirm that the use of Swinblog generated reasonable user interest in the blogging activity, helped in improving online collaboration and highlighted potential drawbacks of academic blogging in both case studies.

**Feedback on unit bookmarks page:** The user access (at least once per week) of unit bookmarks page improved (from 35% to 40%) in the second case study but generated lesser number (15%) of online contributions (at least one bookmark per student) as compared to the first case study. However a reasonable majority (67%) still liked the idea of using social bookmarks and (58%) agreed that social bookmarking improved collaboration and communication among lecturers and students. The second case replicated the results of the first case study in terms of privacy and security issues as 42% of respondents preferred to be anonymous and felt that their identity hindered their participation on the unit bookmarks page. However, 62.4% were overall satisfied with the use of social bookmarking in unit teaching, which is lower than the figures of 72.7% in the first case study.

These findings show that Swinbookmark remained the least preferred technology in both case studies and privacy and security were the key concerns toward usage of academic social bookmarking.

**Feedback on lecture podcasts / vodcasts:** The results of the second case study confirmed that audio and video recordings of lectures remained the mostly used technology as more than 1000 hits were tracked in Blackboard. Similarly ‘manual download’ remained the most preferred way of downloading (59.6%) while ‘home’ was the most preferred place (66.1%) to use podcasts. Surprisingly, (53.2%) respondents preferred to use podcasts in their future units in the second case study as compared to their previous preference of vodcast. This was perhaps due to the problems they had faced in terms of bandwidth limit and excessive time required to download large video
files in the first case study. The number of respondents who reported that the availability of podcasts had affected their attendance was dropped from 58.8% to 41.3% in the second case study however almost similar number (45%) of respondents preferred to use podcasts at their convenient times rather than going to lectures, in both case studies. Again, a good majority (70%) appeared overall satisfied with the use of podcasting in unit teaching.

Thus the above results show that podcasting remained the most preferred technology, accessed by a big majority of students in the class and helped in complementing the lecture contents in both case studies.

### 4.8.6 Analyses on academic performance

Chi-Square analyses of academic performance and various learner types also replicated the results of the first case study as no significant differences were found in the performance of low, average or high performers among various learner types. Similarly, no differences were found in the performance of males and females or among various age groups.

Thus, it is evident that the second case study helped in replicating the major findings of the first case study and fulfilling the anticipated research objectives laid down in Chapter 1.

### 4.9 Key contributions, implications and limitations of the two case studies

#### 4.9.1 Theoretical contributions

The two case studies reported in this chapter advanced the literature of e-learning in terms of highlighting the significant relationships among learning styles and technology preferences for various Web-based technologies. They also contributed towards practice of Web 2.0 or social software in academia and finding effective ways of integrating
technologies based on a student-centred approach. Several significant relationships were observed when various learner types were correlated and a number of associations were found when preferences of various technologies were correlated with each other. The two case studies also highlighted the unique learning styles and preferences of the net generation in terms of their keenness to experience a variety of new technologies. This was perhaps due to their digital literacy and easy access to the latest ICTs as compared to their predecessors. The use of Web 2.0 technologies over a period of two semesters in unit teaching also helped in exposing the usage patterns, preferred features and potential drawback of their usage, which can serve as a guideline for academics who wish to integrate Web 2.0 technologies in unit teaching.

A major contribution of the two case studies was the identification of significant relationships between various learner types and preferences of using Web technologies (Sections 4.4.5 and 4.8.3). For example, reflective learners preferred to use blog more than the active learners. Felder suggest that reflective learners learn by thinking things through and prefer working alone (Felder, 1996) therefore blog was a good choice for them to first go through the learning and collaborative activities taking place on the unit blog and then participate in those activities at their own pace. Similarly, sensing learners preferred email more than intuitive learners. As sensors are those who feel more comfortable with details and happen to be more careful (Felder & Soloman, 1993). Therefore, they preferred to rely on traditional communication tools like email as compared to blog or wiki. Intuitive learners, on the other hand, are defined as those who prefer discovering possibilities and relationships and are always ready to try out new things. This characteristic of intuitors was highlighted by their preference for blogs over other traditional technologies like email. The relationship between verbals and podcasts was justified by the fact that every learner learns more when information is presented both verbally and visually (Felder & Soloman, 1993) as in this thesis where both audio and video of lecture recordings were provided. Hence podcast was an appropriate choice for verbal learners. The relationship between visual learners and vodcast was a natural phenomenon as visuals learn best from pictures, diagrams, flow charts, and demonstrations (Felder & Soloman, 1993). Similar trends were reported in the study of Zywno and Waalen where active, intuitive and visual learners were the most frequent users of hypermedia-based instructions (Zywno & Waalen, 2002). Finally, sequential
learners tend to gain understanding in linear steps and follow logical stepwise paths, hence podcast was a good choice for them to run lecture recordings at their own pace over and over again to get a better understanding of the course contents.

Another significant outcome of the two case studies was the achievement of well-balanced academic performances across all learner types (Sections 4.7 and 4.8.6). No significant differences were found on the proportion of high, average or low performers across various learner types, age-groups or genders. This was consistent with the findings of Akkoyunlu and Soylu, where no significant differences were found between students’ achievement levels according to their learning styles (Akkoyunlu & Soylu, 2008). Sun et al., also reported that Web-based virtual learning environment was suitable for various learner types as no significant differences were found in their grade achievements (Sun, et al., 2008). This shows that accommodating needs and requirements of all learner types (i.e., matching learning styles with technology preferences) might have helped achieving the well balanced performances across the whole unit. However, this was in contrast with some earlier studies where academic performance was heavily biased towards particular learning styles. For example, Chimillard and Karolick reported that reflective and verbal learners performed better than others in their study (Chamillard & Karolick, 1999). Similar findings were reported in some other studies such as: (Thomas, et al., 2002) and (Allert, 2004).

### 4.9.2 Practical implications

The two case studies helped in highlighting several significant relationships among various learner types such as the relationship between reflective and verbal learners and intuitive and global learners. Similar findings were reported by Alfonseca et al., while analysing the impact of various learner types on student groupings (Alfonseca, Carro, Martin, Ortigosa, & Paredes, 2006). These findings can be used by academics as a guideline to form suitable groupings in assignments or projects.

The results of the two case studies also exposed a number of significant relationships among preferences of using various technologies (Section 4.4.4), which leads to the fact that today’s learners are more flexible in stretching their learning styles and
Chapter 4: Integrating Web 2.0 Technologies in Unit Teaching

accommodating a variety of teaching methods. These findings also confirmed that today’s students prefer to use both synchronous and asynchronous communication tools in their academic communication as opposed to the findings of Butler and Pinto, where students only preferred to use asynchronous tools (Butler & Pinto-Zipp, 2006). The findings also confirmed that today’s students are ready to experience new technologies in their study routines and are willing to collaborate using a variety of communication modes. These outcomes are encouraging for lecturers and practitioners of Web 2.0 technologies who wish to experience a variety of technologies in unit teaching.

The identification of significant relationships among various learner types and technology preferences was a significant outcome and could serve as a guideline for lecturers choosing the right technology for the right audience.

4.9.3 Limitations of the two case studies

Like any other user study, the case studies reported in this chapter have some limitations too. The first limitation of these case studies was the involvement of students from an IT background which could have caused a bias towards a certain type of learning style. Also, IT students are considered to be more comfortable with the use of technology as compared to the students from arts or humanities disciplines. Therefore, the inclusion of students from non-scientific background in our future studies would shed more light on the topic. Another limitation of these studies was the use of self-reported data. However, this aspect was beyond our control as the research design required no control over behavioural aspects of student participation. Finally, the achievement of well-balanced academic performances could be influenced by other contributing factors such as: students’ prior knowledge of Web programming; motivation for the unit; assessment techniques; or sample size.

4.10 Summary

This chapter presented findings of the two cases studies that were carried out to fulfil the first research objective of this thesis, i.e., how to effectively integrate Web 2.0
technologies in higher education? Following a student-centred approach, the two case studies were designed to analyse the usage of Web 2.0 technologies in a higher education setting based on the match between students’ learning style and technology preferences. Both case studies helped in fulfilling the above objective by collecting user data through online questionnaires, performing statistical analyses to highlight significant relationships, and integrating Web 2.0 technologies in unit teaching based on the above analyses. Findings suggest that today’s learners are flexible in stretching their learning styles and are able to accommodate varying instructional strategies including the use of Web 2.0 technologies. They further suggest that learning styles of today’s learners are flexible enough to experience varying technologies and their preferences are not limited to a particular tool. In addition, addressing the needs of all learner types (in terms of matching students’ learning styles with their preferences of Web technologies) contributed towards achieving well-balanced academic performances in the units. The results of two case studies are encouraging for lecturers and practitioners of Web 2.0 technologies who wish to facilitate teaching and learning through the use of emerging Web technologies. The outcomes are also encouraging to extend this research and perform future studies with students of non-scientific background in order to strengthen our research outcomes.
5 Effect of Cognitive Styles on User Acceptance of Blogs and Podcasts

Curry’s *Onion model* presented earlier in Chapter 2 (Section 2.2.3.1) comprised three layers (Curry, 1983). The first or outmost layer contains individual’s instructional preferences which are considered less stable personal traits. These traits relate to individual’s attitudes or behaviours towards a particular system or object, which can be learned through personal experiences. The second and third layers contain learning styles and cognitive styles respectively, which are considered more stable. The inner layers have the ability to influence outer layers or the less stable personal traits, which has been demonstrated in this thesis by analysing the effects of students’ learning styles on their instructional preferences for Web 2.0 technologies, as explained in Chapter 4. This chapter presents details of a user study to examine the effects of students’ cognitive styles on their intentions to use two popular Web 2.0 technologies, blogs and podcasts, in a higher education setting. Kirton’s adaption – innovation (AI) theory (Kirton, 1976) was applied to distinguish study participants as adaptors or innovators while Davis’s technology acceptance model (TAM) (Davis, 1989) was used as a baseline to examine usage intentions for blogs and podcasts. To this extent, a structural model was presented and later evaluated in this chapter.

The chapter starts with a review of blogs and podcasts usage in education; technology acceptance model (TAM); and an overview of cognitive styles and their categorisation as adaptors and innovators. This discussion leads to the development of research hypotheses and an extended TAM to examine the effects of students’ cognitive styles on their intentions to use blogs and podcasts. The chapter also highlights the adopted methodology, which includes survey instrument development, data collection and conduct of survey with students of a Web programming unit. The proposed hypotheses and structural model were evaluated using PLS. The chapter concludes with a detailed
discussion of the key findings and contributions, research and practical implications along with some limitations of the study.

5.1 Background and hypotheses development

5.1.1 Educational uses of blogs and podcasts

Blogging has received increased attention in both professional and academic circles as it becomes more prevalent (Rainie, 2005). However, the literature on academic usage of blogs provides some conflicting reports. For example, blogs are reported to have successfully contributed towards students’ online engagement (Lin, et al., 2006); helped students to share their learning experiences and express their thoughts to the lecturers and peers through the unit blog (Maag, 2005); and, sparked reflective learning and satisfaction among students (Dickey, 2004). On the other hand, many blog sites were claimed to be abandoned soon after their creation (Arnold, 2008) or found to be unproductive in terms of interactivity among students (Divitini, et al., 2005). Similarly, improvements in writing skills, convenience of readable and searchable reports and creation of shared repository have been reported as some benefits of using blogs in academia while the inability to allow direct reactions, the messy structure of multiple reactions on a single post and the lack of media richness are reported as drawbacks of academic blogging (Kloos, 2006). Therefore, it is important to know what motivates people to use blogs and what measures could increase the blog usage in academia?

Podcasting is another popular Web 2.0 technology among people from all different walks of life with all sorts of interests including education and the use of academic podcasting is also on the rise (Brittain, et al., 2006; Ractham & Zhang, 2006; Richardson, 2006). A notable example of academic podcasting is the ‘Duke iPod First-Year Experience Project’ in which Duke University used iPods as a course content dissemination tool, classroom recording tool, field recording tool, study support tool, and file storage and file transfer tool (Belanger, 2005). One of the key benefits of academic podcasting is the any-time any-where availability of lecture recordings (audio and video) for students. Podcast also provides an innovative and exciting way of
improving communication, collaboration and social networking (Ractham & Zhang, 2006) and has been reported as a more flexible and effective method than traditional methods of Websites and printed handouts (Chan & Lee, 2005). Despite these benefits, very little empirical research is available on user acceptance of academic podcasting or about significant determinants of podcast usage. At the time of conducting this study, no formal empirical study was available addressing user acceptance of podcasts in academia. This study is one of its kinds that empirically examines the impact of students’ cognitive styles on user acceptance of podcasts in educational context (Saeed, et al., 2009a).

### 5.1.2 Technology acceptance model (TAM)

In Information Systems (IS) research, several theoretical models and frameworks attempt to explain or predict a person’s decision to accept a new technology (Chakraborty, et al., 2008). Of particular importance is the Technology Acceptance Model (TAM), originally developed by Davis and his colleagues (Davis, et al., 1989) in order to explain or predict individuals’ acceptance of computer based systems in various scenarios and organisational contexts. TAM posits that user perceptions of usefulness and ease-of-use determine attitudes towards using the system or technology while individual’s attitude is hypothesised to influence behavioural intention to use a technology, which in turn leads to actual use. Perceived usefulness is also influenced by perceived ease-of-use because the easier the system (technology) is, the more useful it can be (Venkatesh & Davis, 2000). In general, perceived usefulness reflects an individual's subjective estimation of the job performance enhancement that is likely to result from the use of a new technology, whereas perceived ease-of-use refers to the degree to which he / she expects the use of technology to be free of effort (Davis, et al., 1989). TAM is also the mostly used and cited model in IS research and because it incorporates findings accumulated from over a decade, it may be especially well suited for modelling computer acceptance (Davis, et al., 1989).

TAM also theorised that the effects of external variables on intention to use are mediated by perceived usefulness and perceived ease-of-use. Davis suggested that external variables bridge the internal beliefs, attitudes and intentions represented in
Chapter 5: Effect of Cognitive Styles on User Acceptance of Blogs and Podcasts

TAM and various individual differences, situational constraints and managerially controlled interventions imposed on behaviour (Davis, et al., 1989). In this study, students’ cognitive styles are used as an external variable that influence the perceived usefulness and ease-of-use of blogs and podcasts in a higher education setting.

TAM has been used in a number of studies measuring user acceptance of Web and associated technologies (Napaporn, 2007); Web-browsers (Morris & Dillon, 1997); Web-based learning systems (Halawi & McCarthy, 2007); multimedia learning systems (Saade, et al., 2007); and, Web usage behaviour (Shih, 2004). A limited number of studies have also used TAM to measure the user acceptance of Web 2.0 technologies. For example, Hsu and Lin examined the continued usage of blogs and reported that social factors and attitude significantly influenced the blog usage (C. Hsu & Lin, 2008). However, the study was not conducted in the academic context. Similarly, in an attempt to gauge students’ opinions about podcasting, Gribbins collected data about some TAM constructs (perceived usefulness, user attitude and behavioural intention) and reported students’ positive behaviour toward usefulness of podcasting (Gribbins, 2007). However, the effectiveness of podcasting was questioned by the majority of students and the study also lacked in providing a concrete structural model to explain the usage of academic podcasting. This thesis presents and empirically evaluates an extended TAM to examine the effects of students’ cognitive styles on user acceptance of blogs and podcasts.

Based on TAM’s postulates, user perceptions of usefulness and ease-of-use determine the attitudes towards using the system or technology while individual’s attitude is hypothesised to influence the behavioural intentions to use a technology. Using this approach, we propose the following hypotheses:

**H1.** The perceived ease-of-use (PEU) will have a positive effect on user’s attitude (ATD) to use blog / podcast.

**H2.** The perceived ease-of-use (PEU) will have a positive effect on perceived usefulness (PU) of blog / podcast.
**H3.** The perceived usefulness (PU) will have a positive effect on user’s attitude (ATD) to use blog / podcast.

**H4.** The perceived usefulness (PU) will have a positive effect on behavioural intention (BI) to use blog / podcast.

**H5.** The user’s attitude (ATD) will have a positive effect on behavioural intention (BI) to use blog / podcast.

### 5.1.3 Effects of cognitive style on technology acceptance

Cognitive styles generally relate to strategies of creativity, problem solving and decision making and are considered as stable personal traits (Kirton, 2003). Cognitive styles have been categorised according to different classification schemes such as: field dependent - independent; adaptive - innovative; or wholist - analytical and verbaliser - imager. However, in this study, adaption - innovation (AI) theory has been used as it applies broadly in a variety of psychometric and technology acceptance studies (Chakraborty, et al., 2008). AI theory states that a person’s cognitive style in a decision-making context can be classified as *adaptive* or *innovative* on a continuum anchored at ‘extremely adaptive’ or ‘extremely innovative’ (Kirton, 1976). The theory recognises that everybody contributes creatively and both skills (adaption - innovation) are necessary for problem solving or decision making (Kirton, 2003). In general, adaptors prefer operating within a consequently agreed upon paradigm and are often skilled at initiating changes to improve or adapt current methods of doing things. Innovators, on the other hand, prefer working outside an agreed upon paradigm and often effectively initiate changes that manifest different ways of doing things (Chakraborty, et al., 2008).

As adaptors and innovators both possess unique qualities, they are likely to have diverse influence on the usage of technology. Consequently, this will help finding optimal ways of technology usage across various learner types. Existing studies show that matching cognitive styles with teaching methods is advantageous to academic achievements (Smith & Dalton, 2005). Similar studies involving technology acceptance have shown credible link between cognitive styles and individual’s decision making (Dickson, DeSanctis, & McBride, 1986; A. Harrison, W & Rainer, 1992). This thesis attempts to
Chapter 5: Effect of Cognitive Styles on User Acceptance of Blogs and Podcasts

examine the effects of students’ cognitive style (as adaptor - innovator) on their intentions to use blog and podcast and hypothesise the following:

**H6.** Students’ cognitive style (CS) will have an important effect on perceived ease-of-use (PEU) of blog / podcast; specifically, innovators are more likely to perceive blog / podcast easy-to-use as compared to adaptors.

**H7.** Students’ cognitive style (CS) will have an important effect on perceived usefulness (PU) of blog / podcast; specifically, innovators are more likely to perceive blog / podcast useful as compared to adaptors.

Based on the above hypotheses, an extended TAM is presented including students’ cognitive style as an external variable, as shown in *Figure 5.1*.

![Figure 5.1: An extended TAM to examine effect of cognitive styles on user acceptance of blogs / podcasts](image)

**5.2 Methodology**

**5.2.1 Survey participants and data collection**

The study was conducted in Semester 2, 2008 and data for this study were collected from undergraduate and postgraduate students enrolled in an introductory Web programming unit at Swinburne University of Technology. An ethics clearance was
obtained before conducting the survey, clearly stating that the student participation will be on a voluntary basis with no effect on class participation or academic performance in any way (Appendix E). At the start of the semester, students were invited (through emails and Blackboard announcements) to take part in an online survey to express their intentions to use blog and podcast in a higher educational setting.

5.2.2 Measures

The scales for perceived usefulness (PU) and perceived ease-of-use (PEU) were adopted from (Davis, et al., 1989) and (Igbaria, 1990) respectively while the scales for attitude (ATD) and behavioural intention (BI) were adopted from (Venkatesh, et al., 2003). The above constructs were measured on a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The reliability of TAM measures has been discussed in numerous studies of technology acceptance including usage of Web and related applications. For example, a meta-analysis of 88 different TAM-studies with 12,000 responses revealed that TAM measures are highly reliable and may be used in a variety of contexts (King & He, 2006). Similarly, in another study, Hendrickson et al. reported that Davis’ instruments (perceived usefulness and perceived ease-of-use) exhibit a high degree of test-retest validity (Hendrickson, Massey, & Cronan, 1993).

The students’ cognitive styles were measured using Kirton’s Adaptive-Innovation (KAI) inventory (Bagozzi & Foxall, 1995) including 32 items (CS) on a five point Likert scale from 1 (very easy) to 5 (very difficult). These scales indicate the degree of ease or difficulty with which the participant thought he or she could present the image portrayed by the measurement item (Chakraborty, et al., 2008). A low composite score, summed across all measurement items, suggests a cognitive style that leans toward the adaptive anchor of the continuum whereas a high composite score reveals a cognitive style relatively closer to the innovative anchor. This inventory has been utilised to provide better understanding of cognitive styles (Buffington, Jablokow, & Martin, 2002; Jablokow & Booth, 2006; Mudd, 1996), diversity among teams (Buffington, et al., 2002; Foxall & Hackett, 1994; Tullet, 1995), problem solving (Buttner & Gryskiewicz, 1993; Kaufmann, 2004; Talbot, 1997), and many other organisational situations.
Jablokow and Booth reported that KAI has been the focus of at least 90 graduate theses and over 300 scholarly research articles, each of which claim supportive conclusions as to the validity of the theory/inventory. Similarly, a comparison of the psychometric data obtained from the five different language versions of the KAI shows a high degree of overlap in the results, which adds to the growing body of evidence in support of KAI’s construct validity (Tullett & Kitton, 1994). The complete questionnaire including all constructs is presented in Appendix F.

5.3 Empirical evaluation of the proposed hypotheses / model

The research hypotheses and structural model were tested using the PLS approach. PLS is considered as a powerful tool in analysing structural models involving multiple constructs and multiple indicators. Previous research shows that the PLS approach is more suitable for prediction as compared to other approaches like LISREL and EQs, because it assumes that all the measured variance in the study will be explained and it imposes minimal demands in terms of sample size (Chin, 1998b; Saade & Bahli, 2005). Unlike other structural equation modelling approaches such as LISREL, the primary objective of the PLS approach is maximisation of variance explained, not minimisation of the difference between the observed and the reproduced covariance matrices. Thus the quality of the PLS approach can be determined by examining the $R^2$ values (variance) of the dependant constructs (e.g., behavioural intention (BI)) (Hulland, 1999). The PLS approach has been used in several other studies of technology acceptance such as (Raaij & Schepers, 2008), (Saade & Bahli, 2005) and (Mun & Hwang, 2003), thus deemed suitable for our study. After ensuring the reliability and validity of the scales, the proposed hypotheses were tested using the bootstrap re-sampling procedure (Cotterman & Senn, 1992) with 200 re-samples in PLS Graph 3.0.

5.3.1 Demographics

Out of 197 students in the unit, 187 responded to the survey questionnaire with a response rate of 94.9%, including 162 males and 25 females. The mean age of the participants was 27, ranging from 17- 40. Nearly 66% had more than six months
blogging experience while the major reason for blogging by the majority (67%) was ‘Study’. Nearly 50% reported at least six months experience with podcasts while the major use of podcasting by the majority (62%) was also ‘Study’.

5.3.2 Data validity and reliability

Table 5.1 presents summary of all measurement scales including mean, standard deviation (SD), factor loadings (FL), t-values, composite reliability (CR) and average variance extracted (AVE) for both technologies (blog and podcasts).

<table>
<thead>
<tr>
<th>Construct items</th>
<th>Mean</th>
<th>SD</th>
<th>FL</th>
<th>t-values</th>
<th>CR</th>
<th>AVE</th>
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<tr>
<td>PU</td>
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<tr>
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Table 5.1: Construct reliability measures

The factor loadings provide evidence for convergent validity as the majority of constructs load greater than the threshold of 0.60 (Chin, 1998a). Some authors even suggest a value of 0.5 as acceptable (Peterson, 2000). The items CS2 (for blog) and ATD2, ATD3, CS2 (for podcast) construct items were removed from the final evaluation as they had insignificant effect on AVEs of CS and ATD constructs. But CS6 (for blog) and CS5 (for podcast) items were retained as they did not affect the significance of CS construct. The t-values of the Outer Model Loadings in PLS also provide evidence for convergent validity as all values were above 1.96 (Gefen & Straub, 2005). Internal
consistency appears significant for all constructs since the composite reliability values exceeded the minimum value of 0.70 (Nunnally & Bernstein, 1994). AVE measures the variance captured by a latent construct and should load 0.50 or above (Fornell & Larcker, 1981), as evident in our study. Based on the results of a pilot study, we adopted only 8 items (which are shown in bold in the Questionnaire presented in Appendix F) for the CS construct in the main study.

Discriminant validity was met by using the Fornell and Larcker test (Fornell & Larcker, 1981). The procedure involved computing the square root of AVE of each construct, which should exceed the correlation shared between the construct and other constructs in the model. Table 5.2 shows that the square roots (in bold) of all AVEs (on the diagonal) are greater than the cross-correlations of all other constructs. Thus all constructs demonstrated a good degree of validity and reliability.

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Table 5.2: Discriminant validity of constructs

5.3.3 Hypotheses and model testing

The proposed hypotheses and structural models were evaluated by examining the significance of path coefficients and the variance explained ($R^2$) by the dependent variables. Figures 5.2 and 5.3 summarise the results of hypotheses testing for students’ intentions to use blog and podcast respectively. The strength and significance of each
relationship are represented by the path coefficient values, with t-values in parentheses. $R^2$ (variance explained) is indicated next to each dependant variable (BI, ATD, PU and PEU).

![Diagram of relationship between variables]

Figure 5.2: PLS results – Effect of cognitive styles on user acceptance of blogs

Notes: * Significance at the 0.5 level; ** at the 0.01 level; and *** at the 0.001 level

In Figure 5.2, all TAM constructs appear significant having direct and indirect influence on behavioural intention to use blogs, thus supporting hypotheses H1 - H5. Perceived ease-of-use (PEU) indirectly influenced behavioural intention (BI) to use blogs through perceived usefulness (PU) and students’ attitude (ATD) toward blog usage, with coefficient of 0.19 ($0.37 \times 0.37 + 0.14 \times 0.39$). PU directly and indirectly (through ATD) influenced BI with an overall coefficient of 0.53 ($0.37 + 0.41 \times 0.39$). The attitude (ATD) construct directly influenced BI with coefficient of 0.39. Thus PU appears to be the most significant predictor of blog usage followed by ATD and PEU. PU explained 25% variance in the model while ATD and PEU explained 24% and 16% variance respectively. The external variable, cognitive style (CS), showed a significant influence on both PEU and PU constructs with coefficient values of 0.39 and 0.22, thus supporting hypotheses H6 and H7 respectively. The positive relationships imply that the more the student possesses innovative cognitive style the more s/he would perceive blogs useful and ease-to-use. However, the strength of relationships suggests that our
students perceived blogs more easy-to-use than they perceived it useful. Finally, the structural model presented in Figure 5.2 explains 43% of students’ intentions to use blogs, which validates the significance of the proposed model.

Like blogs, the structural model presented in Figure 5.3 also shows the significant influence of TAM constructs on students’ intentions to use podcasts. PU appears to be the most significant predictor of podcast usage with overall coefficient of 0.51 (0.34 + 0.42 * 0.40) followed by ATD and PEU with coefficients of 0.40 and 0.23 (0.46 * 0.34 + 0.18 * 0.40) respectively. PU explains 31% variance in the model while ATD and PEU explains 29% and 13% variance respectively. Again, like blogs, innovators are more likely to perceive podcasts useful and easy-to-use as compared to their adaptor counterparts (because of the positive relationships). However, a comparison of the coefficient values suggests that cognitive style had a marginally stronger influence on PU and PEU of blogs as compared to that of podcast. Finally the model in Figure 5.3 explains 42% of students’ intentions to use podcasts.
Chapter 5: Effect of Cognitive Styles on User Acceptance of Blogs and Podcasts

5.4 Discussion

5.4.1 Key findings and contributions

The aim of this study is to analyse the influence of students’ cognitive styles on user acceptance of two prominent Web 2.0 technologies, namely blog and podcast. To achieve this, a structural model was presented based on the theories of technology acceptance and adaption – innovation. The data collected from undergraduate and postgraduate students enrolled in an introductory Web programming unit helped in validating the proposed hypotheses and the structural model. PLS findings confirmed all the hypotheses formulated at the start hence provided good support to the model. Several insightful results could be summarised as follows:

First, perceived usefulness appeared to be the strongest predictor of students’ intentions to use blogs and podcast, which confirms prior TAM research in highlighting the strong effect of perceived usefulness on intended technology usage as compared to perceived ease-of-use (Davis, 1989; Koufaris, 2002). The weaker influence of perceived ease-of-use on user acceptance has been reported in previous studies of technology acceptance (Raaij & Schepers, 2008). Davis also observed that when users learn to effectively use the system, the direct effect of ease-of-use on the system use disappears (Davis, 1989). In this study, the perceived ease-of-use seemed to influence the use intentions through the process of internalisation (via perceived usefulness and attitude variables). Thus in overall terms, the basic TAM constructs demonstrated a significant effect on students’ intentions to use blogs and podcasts.

Second, a comparison of the mean values (from Table 5.1) and path coefficient values (from Figures 5.2 and 5.3) showed a marginally stronger influence of PU and PEU of blogs as compared to that of podcasts, which highlights students’ fondness towards blogs along with podcasts and prompts the need to combine emerging Web 2.0 technologies in our unit designs. Despite the dominance of podcast usage reported in our previous studies (Chapter 4), the current study highlighted the importance of academic blogging. Given that a podcast is an audio (or video) file, students would have definitely found it useful in terms of listening (or watching) and gaining information...
however it becomes cumbersome to readily apply it for enhanced learning experience either to search a particular keyword, share parts of the file with peers or to listen to by sections. Obviously, in comparison, blog which is made up blocks of text is truly easy to use. Text appearing in blogs could be copied, disseminated and edited with self made extended notes.

Third, the variance explained ($R^2$) by the structural model in Figures 5.2 and 5.3 confirmed the significance of the proposed model as it explained 43% and 42% of students’ intentions to use blogs and podcasts respectively. These figures are quite significant when compared with similar studies of technology acceptance such as (Mun & Hwang, 2003; Raaij & Schepers, 2008; Saade & Bahli, 2005).

Finally, the study contributes to the field of technology acceptance by advancing the significant effect of cognitive styles on user acceptance of blog and podcast in a higher education context. Students’ cognitive style appeared as a strong antecedent of perceived usefulness and perceived ease-of-use of blog and podcast which ultimately influence students’ intentions to use these technologies. The findings suggested that innovators perceive new technology more easy-to-use than their adaptor counterparts, which was consistent with the findings reported in (Chakraborty, et al., 2008). As innovators are considered ingenious, original, and unconventional, discover problems and avenues for their solutions more easily as compared to adaptors (Hipple, Hardy, Wilson, & Michalski, 2001), the use of new technology would definitely be easier for them as evident in this study. The PLS findings also highlight the usefulness of podcasts, as echoed by several other studies such as (Bongey, Cizadlo, & Kalnbach, 2006) and (Evans, 2007) where students found podcasts to be extremely useful, effective, efficient and easily received learning tool for lecture revision.

### 5.4.2 Research and practical implications

This study has implications for both research and practice. First, the educators should pay attention to highlight students’ cognitive styles or their preferred ways of solving problems in terms of the use of technology. To this extent, they should target students
with innovative cognitive styles to be early adopters and utilise them as a catalyst for technology dissemination in the unit.

Second, the study has implications for educators who wish to incorporate emerging Web technologies like blogs and podcasts in their units: they should employ pedagogical principles in the development of meaningful and media rich content to increase the usage of educational blogs. The results also highlight the importance of general training to establish a baseline readiness for advanced technologies like blogs and podcasts. The findings also encourage the use and staged exposure of varied technologies to students. This will boost their competence perception in utilising and venturing out to adopt other new technologies as they embark on further studies.

5.4.3 Limitations

First, as all the data for this study were self-reported and collected through the same questionnaire at the same time, it might have caused common method variance (CMV) or common method bias (CMB) in the study. CMV is the variance that is attributed to the measurement method rather than the constructs of interest and may cause systematic measurement error and further bias the estimates of the true relationship among theoretical constructs (Zen, 2007). A statistical remedy to detect CMV is Harman's single factor test (Podsakoff & MacKenzie, 2003). This procedure requires that an un-rotated factor analysis be performed on all the variables under consideration. If a single factor emerges or one general factor explains most of the covariance in the independent and dependent variables, it indicates that a significant CMV is present (Podsakoff & MacKenzie, 2003). We performed Harman's single factor test to detect the presence of CMV in our study. The results of the un-rotated factor analysis on 25 variables (PU = 6; PEU = 4; ATD = 4; CS = 8; BI = 3) indicate the presence of five factors, the same number of the factors included in our research model. The results of un-rotated factor analyses are presented in Appendix G and indicate that the sample lacked a significant presence of CMV.

Second, the low number of female participants could have caused a gender bias thus considered a limitation in our study. Third, as the study participants were IT students...
with some kind of scientific or technological background and familiar with the Web-based technologies especially blogs and podcasts, they could have introduced a subject bias. Therefore, the inclusion of students from a non-scientific background in future studies would strengthen the study results. Finally, the study focused mainly on the influence of cognitive styles on user acceptance of blog and podcast, therefore inclusion of additional behavioural constructs would help predicting students’ intentions to use blogs and podcasts more accurately.

5.5 Summary

The study provided a useful insight into user acceptance of blogs and podcasts and how students’ with different cognitive styles perceive technology. This was done by formulating a structural model based on Davis’s technology acceptance model (TAM) and Kirton’s adaption - innovation (AI) theory. The study was conducted in a higher education setting and students of an introductory Web programming unit participated in an online survey, which was used to collect data in order to validate the proposed model. The empirical evaluation confirmed all hypotheses formulated at the start thus provided good support to the proposed model. Students’ cognitive styles appeared to have significant effect on perceived usefulness and perceived ease-of-use, which finally influenced students’ intentions to use blogs and podcasts. The study confirmed that students with innovative cognitive style perceive technology more useful and easy-to-use as compared to their adaptor counterparts and should be used as a catalyst for technology dissemination or adoption in a class room setting. The study triggers the need for more research on the topic by investigating additional behavioural constructs in order to better predict user acceptance of blog and podcast in academia and utilise them as effective teaching and learning tools.
6 Effect of Media Richness on User Acceptance of Blogs and Podcasts

Effective communication has long been recognised as a key element in problem solving and decision making within and among organisations including educational institutions (Johnson and Keil 2005). With the advent of emerging Web 2.0 technologies, the communication choices have also been expanded. Media Richness Theory (MRT) provides the theoretical basis for examining effectiveness and appropriateness of traditional media (face-to-face meetings, telephone discussion, written documents, etc.) as well as new media (e-mail, v-mail, instant messengers, etc.). However, less is known about media richness of Web 2.0 technologies. This thesis attempts to examine the media richness capabilities of Web 2.0 technologies and its impact on user acceptance. This chapter presents details of an empirical study to examine the effect of media richness on user acceptance of blogs and podcasts in a higher education setting. A theoretical model is presented using TAM and MRT as its theoretical basis. The details of study design and analyses of the key findings are presented along with empirical evaluation of the proposed model. The study findings lead to several implications and the study limitations trigger some ideas for future research.

6.1 Background and hypotheses development

6.1.1 TAM

Davis suggested that the internal psychological variables that are central to TAM mediate the effects of external variables on an individual’s use of an innovation (Davis, et al., 1989). Davis added that external variables bridge the internal beliefs, attitudes and intentions represented in TAM and the various individual differences, situational
Chapter 6: Effect of Media Richness on User Acceptance of Blogs and Podcasts

6.1.2 Media Richness Theory (MRT)

Media Richness Theory (MRT), originally developed by Daft and Lengel, states that the communication efficiency between people is affected by the fitness of the media and the constraints and managerially controlled interventions impinging on behaviour (Davis, et al., 1989). Previous research applying TAM to e-learning technologies has produced mixed results. For example, perceived usefulness (PU) was reported as a significant predictor of both perceived enjoyment and intention to use e-learning technologies (M. K. Lee, Cheung, & Chen, 2005; Liaw, 2008; Ngai, Poon, & Chan, 2007; Raaij & Schepers, 2008) and e-learning effectiveness (Liaw, 2008). Perceived ease-of-use (PEU) on the other hand was not a good predictor of the intention to use a learning management system (LMS) as reported in the two studies (M. K. Lee, et al., 2005; Raaij & Schepers, 2008) however it was significant in another study (Ngai, et al., 2007). Therefore more research is needed to assess the influence of media types on intentions to use e-learning technologies. This study focuses on examining the influence of media richness on usage intentions of two popular Web 2.0 technologies, blogs and podcasts. Based on the original study by Davis, the following hypotheses are tested:

H1. The perceived ease-of-use (PEU) will have a positive effect on users’ attitude (ATD) to use blog / podcast

H2. The perceived ease-of-use (PEU) will have a positive effect on perceived usefulness (PU) of blog / podcast.

H3. The perceived usefulness (PU) will have a positive effect on users’ attitude (ATD) towards blog / podcast.

H4. The perceived usefulness (PU) will have a positive effect on behavioural intention (BI) to use blog / podcast.

H5. The users’ attitude (ATD) will have a positive effect on behavioural intention (BI) to use blog / podcast.
characteristics of the communication task (Daft and Lengel 1986). Media richness is defined as the “capacity to process rich information”, which is based upon the following four criteria (Daft, Lengel, & Trevino, 1987):

1. capacity for immediate feedback;
2. capacity of the medium to have a personal focus;
3. capacity to transmit multiple cues (i.e., body language, facial expression, tone of voice, etc.); and,
4. language variety

Using these categories, media is classified as rich (face-to-face) or lean (text documents). The more attributes the medium possesses, the richer the medium. Researchers of media studies classify technologies such as telephone, email, postal letter, note, memo, flier, and bulletin along their spectrum of media richness. Several other researchers followed a similar approach to classify other media such as video, voice, and pictures being rich and text being lean (Rice 1992; Schmitz and Fulk 1991; Zmud et al. 1990). With regard to the characteristics of communication task, MRT states that the purpose of communication is to reduce uncertainty and equivocality in order to promote communication efficiency, where uncertainty refers to the lack of information and equivocality refers to negotiating meanings of ambiguous situations. Based on this illustration, a rich medium should be able to transmit sufficient amount of correct information in order to reduce uncertainty. It should also be able to process rich information in order to reduce equivocality (Sun and Cheng 2007).

Academic research on media richness provides conflicting results. For example, Kozma states that certain media types are more suitable for the accomplishment of certain kinds of learning tasks and vice versa (Kozma 1994). Clark, on the other hand, states that media selection has no influence on learner achievement and multiple types of media can produce the same achievement results (Clark 1994). A meta-analysis of MRT applied to computer-assisted instruction studies revealed that audio was associated with higher learner achievement scores than the richer medium of video, and text was associated with higher scores than the richer medium of text with graphics (Timmerman & Kruepke, 2006).
Chapter 6: Effect of Media Richness on User Acceptance of Blogs and Podcasts

MRT is considered one of those theories that seem appropriate for developing an understanding about what can be done to improve user interaction in e-learning environments (Trevino, Lengel, & Daft, 1987). Some recent studies of MRT have also discussed the effect of media richness on user satisfaction, which was linked to the intent to use (Liu, Liao, & Jean, 2009). For example, richer video or audio was found to be more closely associated with user satisfaction (Otondo, Van Scotter, & Palvia, 2008). Several previous studies have established the multimedia effects on attitude in a learning environment (Gemino, Parker, & Kutzschan, 2005) and confirm that richer media facilitated social-emotional communications (Kahai & Cooper, 2003) while others have reported that multiple cues could improve but at the same time hindered understanding (Teeni, 2001). Some recent studies have also shown the significant effect of perceived media richness on perceived usefulness (effectiveness) (Liu, et al., 2009) and perceived ease-of-use (efficiency) (K. Chen, Yen, Hung, & Huang, 2008) of e-commerce and e-learning systems respectively. However, no formal empirical study is available to date which addresses the media richness capabilities of Web 2.0 technologies or examines the effect of media richness on usage intentions for Web 2.0 technologies. This thesis addresses such issues by conducting an empirical study to examine the effect of media richness on user acceptance of blogs and podcasts. Based on the above discussion, perceived media richness (PMR) is considered as an external variable that influences effectiveness (PU), efficiency (PU) and attitude (ATD) toward blogs and podcasts usage and leads to the following hypotheses:

**H6.** The perceived media richness (PMR) will have a positive effect on perceived ease-of-use (PEU) of blog / podcast.

**H7.** The perceived media richness (PMR) will have a positive effect on users’ attitude (ATD) towards blog / podcast.

**H8.** The perceived media richness (PMR) will have a positive effect on perceived usefulness (PU) of blog / podcast.

The above hypotheses resulted in an extended TAM including perceived media richness as significant antecedent of blog / podcast usage, as shown in Figure 6.1.
6.2 Methodology

6.2.1 Data collection and survey participants

The data for media richness of blogs and podcasts was collected at the same time when we collected the data for our study on blogs and podcasts, presented in Chapter 5.

6.2.2 Measures

As mentioned earlier in Chapters 5, the scales for perceived usefulness (PU), perceived ease-of-use (PEU) and behavioural intention (BI) were adopted from (Davis, et al., 1989), (Igbaria, 1990) and (Venkatesh, et al., 2003) respectively. The scales for perceived media richness (PMR) were adopted from (Carlson & Zmud, 1999; Daft, et al., 1987). All of the above items were measured on a seven point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The reliability and validity of the PMR scales used in this study have been discussed in several previous studies of media
richness. For example, Brunelle and Lapierre in their study of testing media richness theory explained consumers’ intentions of buying online reported higher loadings for all four construct items; uni-dimensionality of the measures; highly significant factor loadings (0.70 – 0.96); and, acceptable convergent validity (AVE values from 0.62 to 0.90) (Brunelle & Lapierre, 2008). The reliability of the above construct items was also confirmed with Cronbach’s alpha values from 0.84 to 0.96. Similar scales were used by Lee et al., in order to investigate the perceptual and media selection differences between avatar-based and traditional email. Psychometric properties of the scales were confirmed through convergent (the items measuring the same construct were highly correlated with one another and their factor loading scores were all greater than 0.7) and discriminant validity (all items correlated more highly with other items intended to measure the same factor than with either the same item used to measure a different factor or with different items used to measure a different construct) and reliability (all Cronbach’s alpha were greater than 0.90) (Y. Lee, Kozar, & Larsen, 2009). The construct items for media richness are presented in Appendix F along with the other constructs.

6.3 Empirical evaluation of the proposed hypotheses / model

6.3.1 Data validity and reliability

Table 6.1 presents the summary of all measurement scales including mean, standard deviation (SD), factor loadings, composite reliability, and average variance extracted (AVE). The factor loadings provide the evidence for convergent validity as majority of the constructs loaded greater than the threshold of 0.60 as suggested by (Chin, 1998a). The items PEU1 (for blog) and ATD2, ATD3 (for podcast) were removed from the final evaluation as they had insignificant effect on AVEs of PEU and ATD constructs. However, item ATD2 for blog was retained for final evaluation as it did not affect the significance of ATD construct. Internal consistency also appears significant for all the constructs since the composite reliability values exceeded the minimum of 0.70 as suggested by (Nunnally & Bernstein, 1994).
# Chapter 6: Effect of Media Richness on User Acceptance of Blogs and Podcasts

## Table 6.1: Construct reliability measures

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Table 6.1: Construct reliability measures
Discriminant validity was met using the *Fornell and Larcker test* (Fornell & Larcker, 1981). The procedure involved computing the square root of the AVE of each construct, which should exceed the correlation shared between the construct and other constructs in the model. *Table 6.2* shows that the square roots (in bold) of all AVEs (on the diagonal) were greater than the cross-correlations of all other constructs. Thus the majority of our constructs demonstrated a good degree of validity and reliability.

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*Table 6.2: Discriminant validity of constructs*

### 6.3.2 Hypotheses and model testing

The proposed hypotheses and structural model are evaluated by examining the significance of path coefficients and the variance explained ($R^2$) by the dependent variables. *Figures 6.2 and 6.3* summarise the results of hypotheses testing for blog and podcast respectively, using the *bootstrap re-sampling procedure* with 200 re-samples in PLS Graph 3.0. The *estimated path coefficients* are provided with their significance levels and *t-values* are provided in parentheses. The solid lines represent the significant links between two constructs while the dotted lines represent insignificant relationships. $R^2$ is indicated next to each dependant variable (PU, PEU, ATD and BI).
In Figure 6.2, all original TAM constructs except PEU show significant effect on behavioural intention (BI) to use blogs. PU appeared to be the strongest predictor of intention to use blog with an overall (direct + indirect) coefficient of 0.466 (0.364 + 0.256 \* 0.399) and explained 36% of the variance ($R^2$) in the model. The next biggest predictor of usage intention for blog was attitude (ATD) with direct coefficient of 0.399 and $R^2$ value of 33%. PEU only showed an indirect effect on BI with coefficient of 0.112 (0.307 \* 0.364) and $R^2$ value of 12%. Perceived media richness (PMR) appeared to be a strong antecedent of users’ beliefs and attitudes toward use intentions. PMR showed the strongest influence on PU with direct coefficient of 0.424 followed by ATD and PEU constructs with coefficients of 0.343 and 0.339 respectively. Figure 6.2 shows that all but one hypothesis (H1) were supported and the model explained 43% of usage intentions for blogs in a higher education setting, which is a significant finding when compared with other studies of technology acceptance (Raaij & Schepers, 2008; Saade & Bahli, 2005; Shin & Kim, 2008; Yi & Hwang, 2003).

Figure 6.2: PLS results – Effect of media richness on user acceptance of blogs

Notes: * path coefficient significant at the 0.5 level, ** at the 0.01 level, *** at the 0.001 level; $t$-values in parentheses.
In Figure 6.3, all original TAM constructs demonstrate significant effect on intentions to use podcasts. Like blogs, PU also appeared to be the strongest predictor of BI (coefficient of 0.456; $R^2 = 41\%$) followed by ATD (coefficient of 0.407; $R^2 = 32\%$) and PEU (coefficient of 0.205; $R^2 = 10\%$). Perceived media richness (PMR) also appeared to be a strong antecedent of beliefs and attitudes toward use intentions of podcasts with the strongest influence on PU (coefficient of 0.390) followed by PEU (coefficient of 0.319) and ATD (coefficient of 0.211). Thus all hypotheses in Figure 6.3 were supported and the model explained 42% of usage intentions for podcast in a higher education setting. However, a comparison of the mean values of PU, PEU and ATD constructs for both blogs and podcast (Table 6.1) revealed higher scores for blog as compared to that of podcast. The comparison of path coefficient values from Figures 6.2 and 6.3 also revealed a stronger influence of perceived media richness of blog on PU, PEU and ATD variables as compared to that of podcast. These results suggest that the technology (podcast) with higher media richness (audio / video) did not generate higher levels of PU, PEU and ATD as compared to that of leaner media (text-based blog).

**Figure 6.3: PLS results – Effect of media richness on user acceptance of podcasts**

Notes: * path coefficient significant at the 0.5 level, ** at the 0.01 level, *** at the 0.001 level; 
t-values in parentheses.
### 6.3.3 Significant indicators

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Table 6.3: Significant indicators for interrelationship between behavioural intention to use blogs and podcasts and their antecedents
Table 6.3 summarises the loadings of indicators for each item of the original PMR and TAM constructs. The significant indicators are presented in order of magnitude but we discuss only the most significant predictor (in bold) for each independent variable. In the case of blogs, the most significant indicator of perceived media richness was \( PMR2 \): the ability of blogs to tailor interaction according to ones’ personal requirement (see Section III, Appendix F). Similarly, the overall usefulness of blogs in a class room or work environment (\( PU6 \)); the easiness of blogs to become skilful at (\( PEU4 \)); and, ones’ belief that using blog for learning is a good idea (\( ATD1 \)) were the most significant indicators of the original TAM constructs.

In the case of podcast, the most important indicator of PMR construct was \( PMR4 \), i.e., the ability of podcasts to provide rich and varied language during communication. The most significant indicator of PU was the ability of podcasts to increase learning productivity (\( PU3 \)). Like blogs, \( PEU4 \) and \( ATD1 \) were the strongest predictors of PEU and ATD constructs (for podcasts).

### 6.4 Discussion

#### 6.4.1 Key findings and contributions

The aim of this study was to analyse the media richness of blogs and podcasts and to examine the effect of media richness on user acceptance of these two popular Web 2.0 technologies. To achieve this, a structural model was presented based on the theories of technology acceptance and media richness and later empirically evaluated using PLS. Several insightful results can be summarised from the study as follows:

First, the study confirmed the significance of the original TAM as the majority of hypotheses were confirmed by the data. The only insignificant hypothesis was the influence of PEU on attitude (ATD) towards blog usage. However, similar findings have been reported in several previous studies of technology acceptance (Chau & Hu, 2002; Gao, 2005; Selim, 2003; Szajna, 1996; Wu & Wang, 2005). Raaij and Schepers also observed that the system or technology usage can be influenced more by the
perceived usefulness than by perceived ease-of-use, as users are willing to overcome usability hurdles of system’s environment in favour of the prospect of better academic outcomes (Raaij & Schepers, 2008). These results also support the findings of Liu et al., which suggested that different models might be necessary to explain and predict the user acceptance behaviours under different media richness (Liu, et al., 2009). This indicates the need to investigate other determinants of human behaviour to better predict user acceptance of Web 2.0 technologies.

Second, media richness was found to be a significant antecedent of the original TAM constructs of perceived usefulness, perceived ease-of-use and attitude, which ultimately influenced usage intention towards blog and podcast. This is consistent with the findings of Liu et al., which reported the significant influence of media richness on perceived usefulness and concentration of e-learning technology acceptance (Liu, et al., 2009). However, our study reports a relatively stronger influence of media richness on PU as compared to PEU and ATD, suggesting that effectiveness (PU) of blogs and podcasts surpass the efficiency (PEU) attribute when it comes to the usage of Web 2.0 technologies in a higher education setting. Another significant finding of our study was the strong influence of media richness on usage intentions toward blog as compared to that of podcast, which suggests that technologies with lean media richness (such as text-based blogs) exhibit stronger influence on usage intentions (decision making) as compared to technologies with higher media richness (such as audio / video-based podcast). Our study confirms Liu et al. findings in terms of reporting significant effect of media richness on TAM constructs however it conflicts with their finding that higher media rich presentations (text-audio-video) generate higher levels of PU than text-audio or audio-video-based presentations (Liu, et al., 2009). It is also in line with Matarazzo and Sellen’s study, which reported that a higher quality video presentation causes distraction from task completion (Matarazzo & Sellen, 2000).

Third, the study highlights the significant indicators of media richness for blogs and podcasts. For example, the ability of blogs to tailor interaction according to ones’ personal requirement was the most significant indicator of its media richness. This is consistent with some previous studies which highlighted blog’s abilities to promote online engagement (Lin, et al., 2006); sharing of learning experiences among students
and expressing their thoughts to the lecturer (Maag, 2005); and, convenience of readable and searchable reports and creation of shared repository (Kloos, 2006). In the case of podcast, the most significant indicator of media richness was its ability to provide rich and varied language during communication. As the audio and video recordings of lectures (in the form of podcasts) are rich in their capacity to transfer rich and varied language, therefore considered useful to revise lecture contents at students’ own pace with the freedom of downloading into their portable multimedia devices (iPods, MP3, MP4 players). Similar trends are echoed in some previous studies about podcasting where it was perceived as an innovative and exciting way of improving communication, collaboration and social networking (Rac etham & Zhang, 2006) and was found to be a more flexible and effective method than traditional methods of Web sites and printed handouts (Chan & Lee, 2005).

Finally, comparing acceptance models with different media types (audio / video-based podcasts versus text-based blogs) show the important influence of media richness on users’ acceptance of Web 2.0 technologies. The influence of different media types on attitude differs depending upon the users’ current stage of technology adoption (Liu, et al., 2009). Therefore, further research is required in this area for a complete evaluation of the user acceptance of Web 2.0 technologies.

The study makes several theoretical contributions. First, it confirms previous research indicating the indirect influence of external variables on user acceptance of information technology (Agarwal & Prasad, 1999; Al-Gahtani & King, 1999; Davis, et al., 1989) and contributes to the technology acceptance research by extending TAM to include MRT in the context of Web 2.0 technologies. Although MRT has been extensively used in several studies of traditional media (telephone, e-mail, discussion boards, etc), this study was the first to examine media richness of Web 2.0 technologies and its impact on usage intentions. Second, the study extends the knowledge of Web 2.0 technologies by highlighting their key indicators of media richness in higher education settings. Third, it contributes to the ongoing debate on significance of MRT: it confirms the influence of media richness on usage intention but contradicts with the claims that technologies with higher levels of media richness generate higher levels of user acceptance (Liu, et al., 2009), hence demands for more research on the topic.
6.4.2 Research and practical implications

The study highlights the media richness capabilities of blogs and podcasts as well as key predictors of their usage. The findings serve as an advice to academics who can be carried away with the media-rich technologies as this aspect did not show precedence on user acceptance of technologies (blogs and podcasts) in our study. Instead, they should choose technology based on the task-fit as in some cases lean media could result in higher satisfaction and acceptance levels than rich media. Nevertheless, the study demonstrates a significant influence of media richness on usage intentions of Web 2.0 technologies hence encourages researchers to further investigate other determinants of technology acceptance in order to fully understand user acceptance of Web 2.0 technologies and their usage in academia. It also provides a baseline to further investigate the media richness of Web 2.0 technologies and invites researchers to compare the media richness capabilities of other Web 2.0 technologies.

6.4.3 Limitations

The limitations presented earlier in Chapters 5 also apply here as the data for this study came from the same sources. The problem of common method bias was addressed by performing the Harman’s single factor test as explained earlier in Chapter 5 (Section 5.4.3). The results of the un-rotated factor analysis on 21 variables (PU = 6; PEU = 4; ATD = 4; PMR = 4; BI = 3) indicate the presence of five factors, the same number of the factors included in our research model. The results of un-rotated factor analysis are presented in Appendix H, showing that the sample lacked a significant presence of CMV. Also, the use of a similar set of questions (wordings) for apparently two different technologies (blogs and podcast) might have caused an issue of face validity of the constructs used in this study. However, the results of convergent and discriminant validity (in Tables 6.1 and 6.2 respectively) provided good support to the survey instrument used in this study. Finally, the study focused only on examining the effect of media richness on user acceptance, therefore inclusion of additional determinants of technology acceptance in future studies would improve our ability to predict usage intentions of blogs and podcasts more accurately.
6.5 Summary

The study provided a useful insight into the media richness of blogs and podcasts and its impact on user acceptance of these two technologies within higher education. The empirical evaluation of the research hypotheses / model presented in this study showed a significant influence of media richness construct on use intentions for blog and podcast. This highlighted the importance of media richness while examining usage of Web 2.0 technologies. However, the study challenged the dominance of rich medium over lean medium in terms of explaining the user acceptance of blogs and podcasts. The diverse influence of media richness on usage intentions of different technologies triggered the need for more research on comparing media richness of Web 2.0 technologies.
7 User Acceptance of Second Life in Higher Education

During the course of this doctoral research, Second Life (a 3-D multi-user virtual environment - MUVE) was getting enormous popularity around the world including Australia. At the same time, Swinburne University of Technology (where this research was conducted) was in the process of creating its virtual campus in Second Life and academics at Swinburne were keen in exploring the teaching and learning benefits of this emerging Web technology. Including Second Life as part of this study seemed rational to achieve its objectives. Further, Second Life blends well with the main theme of this thesis, i.e., exploring the use of Web 2.0 technologies in higher education. All of these factors resulted in a user study to examine user acceptance of Second Life in order to better understand this emerging virtual learning environment and ultimately enhance its usage at Swinburne and elsewhere (Saeed, et al., 2009c). The study also helped in evaluating the capability of traditional technology acceptance approaches (TAM) to explain the usage of today’s highly interactive, multi-user and entertainment oriented technologies such as Second Life.

The chapter starts with a review of the academic usage of Second Life and TAM. An introduction to hedonic consumption behaviours is presented and their impact on individual decision making is explained. This discussion leads to the development of research hypotheses and a structural model to explain the user acceptance of Second Life. The research methodology explains about survey participants and data collection procedures. The details of empirical evaluation include data validation and PLS analysis of the proposed model. The chapter concludes with a detailed discussion of the key findings, theoretical contributions, research and practical implications, and limitations of the study.
7.1 Background and hypotheses development

7.1.1 Educational uses of Second Life

Second Life (SL) provides enormous opportunities to imitate real world situations in a virtual environment. To name a few: reincarnation of ancient architecture and civilizations (R. Harrison, 2009); advertising and selling of real life commodities (Lui, et al., 2007); live music concerts (BBC, 2006; Walsh, 2006); experiencing complex medical procedures discounting dangerous outcomes (Thompson & Hagstrom, 2008); library services (L. Bell, et al., 2007); developing campuses (Lucia, et al., 2009); conducting classes and labs (Holmberg & Huvila, 2008); and many more.

SL offers a variety of potential benefits for educational use including: collaboration and communication; engagement; conducting activities in a risk-free environment; alternative space for instruction and tasks; and visualisation of difficult content (Eschenbrenner, et al., 2009). Richter et al. have identified at least five different types of learner engagements that are possible in SL: experiential, diagnostic, demonstrative, role-play and constructivist (Richter, et al., 2007). SL has the potential for being a useful educational tool for teaching and learning by using a constructivist approach (Coffman & Klinger, 2007), which is the theory of knowledge acquisition obtained through interactions and building upon own knowledge and which produces the highest type of learning according to Bloom (Cheal, 2007). Following this approach, students can discover and create meaningful content and interactions (Stevens, 2006). The immersive nature of SL allows for exploration and interaction with elements in the world. These social interactions create emotional aspects with other residents as well as the environment itself (Nummenmaa, 2007). Educators have explored several uses of MUVEs (SL) such as developing models, simulations, historical recreations, scientific collaborations, and role-playing scenarios tied to academic content. Similarly, teachers in higher education have also found SL a convenient place to conduct online classes, conferences, presentations, and meetings with students (Richter, et al., 2007). However, in order to explore the teaching and learning potential of SL, it is important to understand the factors that affect user behaviour towards SL usage.
Due to the infancy of 3-D MUVEs, very few studies have managed to explain usage or acceptance of this emerging Web technology (Becerra & Stutts, 2008), especially in the educational contexts. For example: Shin & Kim proposed and evaluated an extended TAM including perceived synchronicity, perceived involvement and perceived enjoyment to measure users’ behaviour towards Cyworld (a social networking website) usage (Shin & Kim, 2008); Becerra & Stutts extended the theory of planned behaviour, using socio-metric theory, to explore influences on the use of virtual worlds (Becerra & Stutts, 2008); Chen et al. proposed a structural model to predict acceptance of SL for education (X. F. Chen, et al., 2008) but the study lacked empirical evaluation of the proposed model. This thesis attempts to examine the usage of SL in higher education by exploring the significant predictors of its usage, presenting a structural model including those predictors, and performing empirical evaluation of the proposed model.

7.1.2 TAM

As explained earlier in Chapters 5 and 6, TAM emphasises that perceived usefulness and perceived ease-of-use constitute a significant influence on an individual’s intention to use a technology or system. The mediating role of attitude between these perceptions and behavioural intention has been doubtful from the start of TAM research and was therefore not considered in the follow-up model, TAM2 (Venkatesh & Davis, 2000). Social influences (also referred as subjective norms) were also included in the follow-up model, which is the person’s perception that most people who are important to him or her think that he or she should (or should not) perform the behaviour in question (Fishbein & Ajzen, 1975).

Both TAM and TAM2 have established themselves as being robust and parsimonious for predicting user adoption of a variety of new technologies (Raaij & Schepers, 2008) and have been validated for a variety of productivity-oriented technologies including word processors, e-mail, spread-sheets, Web-based learning systems, and multimedia learning systems (Halawi & McCarthy, 2007; Lederer, et al., 2000; Saade, et al., 2007). However, some recent studies suggest that traditional technology acceptance approaches such as TAM may not work well with today’s highly interactive, multi-user and entertainment-oriented technologies like multi-player online games or MUVEs.
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(Heijden, 2004; C. L. Hsu & Lu, 2004; Koufaris, 2002). Because these technologies enable users to fantasise, role-play and be entertained, it is important to measure their hedonic consumption along with the traditional user acceptance behaviours, in order to better understand their usage. This thesis therefore attempts to investigate the role of hedonic consumption behaviours on user acceptance of SL. This is achieved by presenting an extended TAM including hedonic consumption behaviours and performing empirical evaluation of the proposed model. However, we decided to use the later version of TAM, i.e., TAM2 in this study due to two major reasons: First, SL is considered to be a highly immersive, interactive and social technology as compared to the technologies (podcasts and blogs, social bookmarks) already examined in this thesis. Therefore, the presence of social norms construct in TAM2 would help capture the effect of social pressures on the usage of SL. Second, the investigation of TAM2 along with our earlier investigation of the original TAM (Chapters 5 and 6) would help encompassing a thorough investigation of the TAM phenomena.

As explained earlier in Chapters 5 and 6, TAM’s basic constructs of perceived usefulness and perceived ease-of-use constitute a significant influence on an individual’s intention to use a technology or system (Ma & Liu, 2004). Perceived usefulness is also influenced by perceived ease-of-use because the easier the system (technology) is, the more useful it can be (Venkatesh & Davis, 2000). This leads to the following hypotheses:

**H1.** The perceived ease-of-use (PEU) will have a positive effect on behavioural intention (BI) to use SL.

**H2.** The perceived ease-of-use (PEU) will have a positive effect on perceived usefulness (PU) of SL.

**H3.** The perceived usefulness (PU) will have a positive effect on behavioural intention (BI) to use SL.

Subjective norms is considered to have directly and significantly related to a person’s intention to use a technology or system (Schepers & Wetzels, 2006). Subjective norm is
also considered to have influence on technology acceptance through the perceived usefulness. Such a process is referred as internalisation, which denotes the process by which a person incorporates an important referent’s belief that he or she should perform a particular behaviour into his or her own belief structure (Kelman, 1958); since a large number of people can not be wrong in their opinion, the system must be useful in its purpose (Raaij & Schepers, 2008). Following this approach, we hypothesise that:

**H4.** The subjective norms (SN) will have a positive effect on behavioural intention (BI) to use SL.

**H5.** The subjective norms (SN) will have a positive effect on perceived usefulness of (PU) of SL.

### 7.1.3 Hedonic consumption behaviours

With its roots in marketing research, hedonic consumption designates those facets of human behaviour that relate to the multisensory, imaginary and emotional aspect of one’s experience with products (Hirschman & Holbrook, 1982). The theory asserts that emotional and imaginative responses are the main drivers of hedonic consumption where emotional responses can be explained through the constructs of enjoyment, emotional involvement and arousal while imaginative responses through the constructs of fantasy, escapism and role projection (Hirschman, 1983; Lacher & Mizerski, 1994). Several previous studies have reported the significant effect of hedonic behaviours in explaining the consumption of entertainment-oriented technologies and systems including online games, virtual learning environments, online retail shopping, music, and gambling (Childers, Carr, Peck, & Carson, 2001; Lacher & Mizerski, 1994; M. K. Lee, et al., 2005; Shin & Kim, 2008; Titz, Andrus, & Miller, 2002; Yi & Hwang, 2003). Hirschman & Holbrook noted that if the consumers knew in advance that hedonic consumption will require a certain level of emotional expenditure and imaginative participation, they may choose to use (or avoid) a certain product (Hirschman & Holbrook, 1982). This is because they wish (or refuse) to make such an investment of their emotional - imaginative resources (Singer, 1966; Zuckerman, 1979). Thus hedonic
consumption could play a vital role in explaining the usage of hedonic products (systems) such as MUVEs or similar technologies. Moreover, the traditional economic view of products as objects would seem inappropriate for products whose usage is based upon satisfying emotional desires rather than fulfilling utilitarian functions. Thus for systems that are hedonic in nature, hedonic factors could be the dominant predictors of usage intentions (J. Kim & Forsythe, 2007). Similarly, for MUVEs, such as SL, that are largely hedonic in nature, we can expect hedonic behaviours to be strong predictors of their usage. Therefore, this thesis examines the effect of hedonic consumption behaviours (in terms of emotional and imaginative responses) on usage intentions for SL.

The hedonic consumption theory focuses on positive behavioural experiences: namely emotional and imaginative responses, which are key human factors and are likely to capture the entertainment nature of the technology of interest (Holsapple & Wu, 2007). The emotional responses can be explained through enjoyment (EN), emotional involvement (EI) and arousal (AR) where enjoyment is the degree to which performing an activity is perceived as providing pleasure and joy in its own right, aside from performance consequences (Venkatesh, 2000); emotional involvement is the degree to which an individual is emotionally engaged in a behaviour; and arousal refers to the state of emotional and mental activation or alertness elicited by external sensory stimulation (Holsapple & Wu, 2007). The imaginative responses can be explained through fantasy (FA), escapism (ES) and role projection (RP) where fantasy refers to the imagined events or sequences of mental images representing an integration of the demands of all the psyche and reality components; escapism is an individual’s desire to escape unpleasant realities; and role projection involves the mental activities whereby individuals project themselves into particular roles or characters (Holsapple & Wu, 2007). Some recent studies have shown the significant effect of hedonic consumption behaviours (in terms of perceived emotional and perceived imaginative responses) on acceptance or usage of entertainment-oriented technologies (Depradine, 2007; Shin & Kim, 2008). Following this trend, we hypothesise as follows:
**H6.** The perceived emotional responses (PER) will have a positive effect on behavioural intention (BI) to use SL.

**H7.** The perceived imaginative responses (PIR) will have a positive effect on behavioural intention (BI) to use SL.

Based on the above hypotheses, an extended TAM2 is presented including hedonic consumption behaviours (in terms of perceived emotional and perceived imaginative responses) as significant predictors of SL usage, as shown in Figure 7.1.

![Figure 7.1: An extended TAM2 to examine effect of hedonic consumption behaviours on user acceptance of SL](image-url)
7.2 Methodology

7.2.1 Survey participants and data collection

As the aim of this study was to examine the user acceptance of SL in the educational context, the target subject’s profile should have included academic-centric participants who either have attended, designed, and conducted classes or have involved in some form of educational activities in SL. Data for this study were collected from a number of resources. The author joined several educational and research groups within SL to get an insight of the current educational activities and to make social contacts with the community. The activity included visits to a large number of educational islands and sending personal invitations to the residents to take part in the online survey. Some personal invitations were also sent to various educational groups in SL. Two popular mailing lists (Second Life Educators mailing list (SLED) and Second Life Research Listserv (Slrl)) were used to invite survey participants. These lists are populated by a large number of geographically distributed and active academic-centric individuals and are considered a constant ground for data collection. Most of the data used in this study came from these two mailing lists. Some recent studies have also adopted similar approaches to explore the usage of SL in the education context (Alvarez, 2006; Boostrom, 2008; Richter, et al., 2007). The total number of valid responses obtained from the above mentioned resources was 122, which sufficed to perform the PLS analysis.

7.2.2 Measures

Multiple items were adopted from the previously published scales for the constructs used in the proposed model. For TAM2, the scales for perceived usefulness (PU), perceived ease-of-use (PEU), subjective norms (SN) and behavioural intention (BI) were adopted from (Davis, et al., 1989), (Igbaria, 1990), (Davis, 1989) and (Venkatesh, et al., 2003) respectively. The validity and reliability of TAM constructs have already been discussed in Chapters 5. The scales for social norms were also obtained from the same sources hence considered authentic.
For hedonic consumption behaviours, the scales for perceived emotional responses (PER) and perceived imaginative responses (PIR) were adopted from (Hirschman, 1983; Hirschman & Holbrook, 1982). The PER construct comprised three items each for enjoyment (EN 1-3), emotional involvement (EI 1-3), and arousal (AR 1-3) while PIR also comprised three items each for fantasy (FA 1-3), escapism (ES 1-3) and role projection (RP 1-3). The above mentioned items were measured on a seven point Likert scale, ranging from 1 (strongly disagree) through 7 (strongly agree). The psychometric properties and reliability of hedonic consumption scales have been discussed in the original studies by Hirschman and her colleagues. For example, Hirschman used regression analysis techniques to examine the characteristics of persons engaging in emotional and imaginative behaviours and commended their validity (Hirschman, 1983). For example, the role projection construct provided an adjusted $R^2$ of .30 and the overall $F$ value of 5.63 was significant at the 0.0001 level. Similarly, the fantasy construct resulted in an adjusted $R^2$ of 0.22 and the overall $F$ value of 3.62 was significant at the 0.001 level, and so on. The complete questionnaire detailing all the above mentioned constructs is available in Appendix I.

### 7.3 Empirical evaluation of the proposed hypotheses / model

#### 7.3.1 Demographics

The study participants included 79 females and 43 males. The mean age of the participants was 42, ranging from 17 - 65 years. Teachers (27%) and Students (25%) constituted the larger groups followed by Researchers (19%), Academic Managers (16%) and Other professionals (13%). Although the survey participants were geographically distributed, the majority of them were from the USA. The majority of participants were well educated as 67.2% of them held postgraduate qualifications. The survey results also showed that 82.8% of participants had Internet experience of more than 9 years, 94.3 % of them used the Internet several times a day and the primary access location of the Internet for 56.6% of participants was ‘Home’. In addition, the majority of participants (81.9%) had at least 6 months experience in using SL. About
half of them reported accessing SL at least once a day and the primary access location for 72.1% of participants was ‘Home’. These results suggest that our participants were of mature age, well educated and geographically distributed. They had extensive experience of using Internet and adequate experience of using SL in academia.

7.3.2 Data validity and reliability

Table 7.1 presents the summary of all measurement scales including mean, standard deviation (SD), factor loadings (FL), composite reliability (CR), and average variance extracted (AVE). The factor loadings provide the evidence for convergent validity as the majority of constructs loaded greater than the threshold of 0.60 as suggested by Chin (Chin, 1998a). However, it is important to mention here that several items of perceived imaginative responses (PIR) did not load significantly (< 0.60). For example, all three items of escapism (ES 1-3) and one item of fantasy construct (FA2) did not load significantly. Similarly, two items of perceived ease-of-use (PEU1 and PEU2) also failed to load significantly. Internal consistency also appears significant for all the constructs since the composite reliability values exceeded the minimum of 0.70 as suggested by Nunnaly and Bernstein (Nunnally & Bernstein, 1994).

<table>
<thead>
<tr>
<th>Constructs Items</th>
<th>Mean</th>
<th>SD</th>
<th>FL</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Emotional Responses (PER)</td>
<td></td>
<td></td>
<td></td>
<td>0.93</td>
<td>0.58</td>
</tr>
<tr>
<td>EN1 6.33</td>
<td>1.09</td>
<td>.69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EN2 6.20</td>
<td>1.05</td>
<td>.80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EN3 6.29</td>
<td>1.14</td>
<td>.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EI1 4.90</td>
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<td>.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EI2 5.58</td>
<td>1.59</td>
<td>.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EI3 5.10</td>
<td>1.68</td>
<td>.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR1 5.40</td>
<td>1.55</td>
<td>.81</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>AR2 5.11</td>
<td>1.51</td>
<td>.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR3 5.94</td>
<td>1.33</td>
<td>.83</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Imaginative Responses (PIR)</td>
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<td></td>
<td>0.83</td>
<td>0.50</td>
</tr>
<tr>
<td>FA1 4.61</td>
<td>2.07</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FA2 4.16</td>
<td>2.09</td>
<td>.54</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>FA3 5.04</td>
<td>1.73</td>
<td>.69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ES1 3.83</td>
<td>1.99</td>
<td>.55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ES2 3.48</td>
<td>1.89</td>
<td>.50</td>
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</table>
### Table 7.1: Construct reliability measures

<table>
<thead>
<tr>
<th></th>
<th>PER</th>
<th>PIR</th>
<th>PU</th>
<th>PEU</th>
<th>SN</th>
<th>BI</th>
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<tr>
<td>PER</td>
<td>.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIR</td>
<td>.49</td>
<td>.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PU</td>
<td>.50</td>
<td>.20</td>
<td>.77</td>
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<td></td>
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<tr>
<td>PEU</td>
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<td>.42</td>
<td>.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SN</td>
<td>.25</td>
<td>.26</td>
<td>.32</td>
<td>.09</td>
<td>.83</td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>.69</td>
<td>.39</td>
<td>.41</td>
<td>.14</td>
<td>.30</td>
<td>.91</td>
</tr>
</tbody>
</table>

### Table 7.2: Discriminant validity of constructs
Chapter 7: User Acceptance of Second Life in Higher Education

Discriminant validity was met using the Fornell and Larcker test (Fornell & Larcker, 1981). Table 7.2 shows that the square roots (in bold) of all AVEs (on the diagonal) were greater than the cross-correlations of all other constructs. Thus all our constructs demonstrated a good degree of validity and reliability.

7.3.3 Hypotheses and model testing

The proposed hypotheses and structural model were evaluated by examining the significance of path coefficients and the variance explained ($R^2$) by the dependent variable (BI). Figure 7.2 summarises the results of hypotheses testing using the bootstrap re-sampling procedure with 200 re-samples in PLS Graph 3.0. The estimated path coefficients are provided with their significance levels. The solid lines represent the significant links between two constructs while the dotted lines represent insignificant relationships. $R^2$ is indicated next to each dependent variable (BI and PU).

Surprisingly, none of the TAM2 constructs were supported by the data as the effect of perceived ease-of-use (PEU), perceived usefulness (PU) and subjective norms (SN) on behavioural intention (BI) appeared insignificant, hence rejecting hypotheses H1, H3 and H4 respectively. However, the mediating effect of PEU and SN on BI could be seen through PU, thus showing support for hypotheses H2 (path coefficient of 0.42) and H5 (path coefficient of 0.28) respectively. The effect of perceived emotional responses (PER) was found to be very strong and positive on BI, thus supporting hypothesis H6 (path coefficient of 0.61). However, perceived imaginative responses (PIR) failed to pose a significant effect on BI thus rejecting hypothesis H7. Therefore, perceived emotional responses of hedonic consumption behaviours appeared as the strongest predictor of usage intentions for SL.

As mentioned earlier in Chapter 5, the primary objective of the PLS approach is the maximisation of variance explained rather than minimisation of the difference between the observed and the reproduced covariance matrices. Thus the quality of the PLS approach can be determined by examining the $R^2$ values of the dependent constructs (Hulland, 1999). The PLS analysis of the original TAM2 model explained only 20% of
users’ intentions to use SL (as shown in Table 7.4). However, the proposed model demonstrated a remarkable improvement as it explained over 51% of the users’ intentions to use SL, as shown in Figure 7.2. This outcome exposes the inability of traditional technology acceptance approaches (TAM) to explain the user acceptance of today’s highly interactive, multi-user and entertainment oriented technologies such as SL.

![Diagram showing hedonic consumption behaviours and TAM2](image)

**Figure 7.2: PLS results - Effect of hedonic consumption behaviours on user acceptance of SL**

*Notes: * path coefficient significant at the 0.5 level, ** at the 0.01 level, *** at the 0.001 level; t-values in parentheses.*
7.3.4 Significant indicators

Table 7.3 summarises the loadings of indicators for each item of TAM2 and hedonic consumption constructs. The most significant indicators are presented in order of magnitude. For hedonic consumption behaviours, arousal (AR) appeared to be the most significant indicator followed by enjoyment (EN) and emotional involvement (EI). The most significant indicator of perceived usefulness was PU2, i.e., the ability of SL to improve class / work performance. Similarly, the flexibility to interact with (PEU3) and the influence of important people on user’s decision to use SL (SN2) were the most significant predictors of perceived ease-of-use and subjective norms respectively.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Significant Indicator</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional Responses</td>
<td>AR</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>EN</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>EI</td>
<td>0.72</td>
</tr>
<tr>
<td>Usefulness</td>
<td>PU2</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>PU3</td>
<td>0.84</td>
</tr>
<tr>
<td></td>
<td>PU1</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>PU5</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>PU6</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>PU4</td>
<td>0.69</td>
</tr>
<tr>
<td>Ease of Use</td>
<td>PEU3</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>PEU4</td>
<td>0.66</td>
</tr>
<tr>
<td>Subjective Norms</td>
<td>SN2</td>
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</tr>
<tr>
<td></td>
<td>SN3</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>SN4</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>SN1</td>
<td>0.78</td>
</tr>
<tr>
<td>Behavioural Intention</td>
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</tr>
<tr>
<td></td>
<td>BI1</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td>BI3</td>
<td>0.88</td>
</tr>
</tbody>
</table>

Table 7.3: Significant indicators for interrelationship between behavioural intention to use SL and its antecedents

Table 7.4 summarises the path coefficients and t-values for interrelationships between the dependent variable (BI) and its antecedents (PEU, PU, SN, PER, PIR). To gauge the impact hedonic consumption behaviours (PER and PIR) have on user acceptance of SL, we first ran the PLS analysis on TAM2. As shown in Table 7.4, TAM2 explained only
20% of usage intentions for SL whereas the model in Figure 7.2 explained over 51% of usage intentions, an improvement of 31% from the original TAM2. These findings imply that hedonic consumption behaviours have played a very significant role in explaining the user acceptance of SL.

<table>
<thead>
<tr>
<th>Path Coefficient</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEU → BI</td>
<td>0.08* (1.17)</td>
</tr>
<tr>
<td>PEU → PU</td>
<td>0.42*** (6.06)</td>
</tr>
<tr>
<td>PU → BI</td>
<td>0.09* (1.17)</td>
</tr>
<tr>
<td>SN → BI</td>
<td>0.10* (1.29)</td>
</tr>
<tr>
<td>SN → PU</td>
<td>0.28** (3.24)</td>
</tr>
<tr>
<td>PER → BI</td>
<td>0.61*** (6.99)</td>
</tr>
<tr>
<td>PIR → BI</td>
<td>0.07* (0.96)</td>
</tr>
</tbody>
</table>

Variance explained ($R^2$) by TAM2: 20%
Variance explained ($R^2$) by extended TAM: 51%

Table 7.4: Path coefficient values for interrelationships between behavioural intention and its antecedents.

Notes: t-value in parenthesis; *ns = non-significant relationship.

7.4 Discussion

7.4.1 Key findings and contributions

The aim of this study was to examine technology acceptance of SL in educational contexts. To achieve this, an extended TAM2 was presented including hedonic consumption behaviours as significant predictors of SL usage. Data for the study were gathered from both in-world (within SL) and external resources (mailing lists) in order to test the proposed model. Several insightful results could be summarised from the empirical study as follows.
First, perceived emotional responses (as explained through the constructs of enjoyment, emotional involvement and arousal) were the strongest predictors of usage intentions for SL, that is, the more the users enjoy, get emotionally involved and aroused with the SL environment, the more likely they will use it. This is consistent with the findings of several previous studies of technology acceptance. For example, Lacher and Mizerski reported that emotional responses had a significant effect on users’ intentions to purchase new rock music (Lacher & Mizerski, 1994). Lee et al. noted that emotional responses, in terms of enjoyment, had the strongest effect on users’ attitudes towards using Internet-based learning medium (ILM) as compared to that of basic TAM constructs (M. K. Lee, et al., 2005). Similarly, enjoyment was found to be the most significant direct predictor of users’ attitudes towards online retail shopping (Childers, et al., 2001). Hsu et al. also reported perceived enjoyment as the most significant predictor of users’ attitudes towards using blogs (C. Hsu & Lin, 2008).

Second, imaginative responses (explained through the constructs of fantasy, escapism and role projection) appeared to have insignificant effect on usage intentions for SL. The insignificant effect of fantasy and escapism was perhaps due to the context of the study, i.e., education. Also, the majority of survey participants was of mature age and perhaps downplayed the notion of fantasy and escapism as a valid reason for using SL. Although some previous studies have reported significant effect of role projection on the usage of virtual environments, this relationship appeared insignificant in this study. This makes imaginative responses insignificant in this study and demands for further investigation into the topic.

Finally, TAM2 constructs of perceived usefulness, perceived ease-of-use and subjective norms appeared to have insignificant effect on usage intentions for SL. This exposes the inability of traditional technology acceptance approaches in explaining the user acceptance of today’s highly interactive, multi-user and entertainment oriented technologies such as SL. Similar concerns are echoed in some recent studies of technology acceptance (Heijden, 2004; Holsapple & Wu, 2007). However, future studies employing other MUVEs would shed more light on the topic.
This study has made several insightful contributions. First, it contributes to the technology acceptance research by extending TAM2 to include hedonic consumption behaviours as significant predictors of SL usage. Although few previous studies have used some of these constructs to explain the acceptance of new technology, this study is the first to include a full range of hedonic consumption behaviours to test the user acceptance of a Web 2.0 technology (SL) in the educational context.

Second, the study contributes toward usage of SL, especially in the educational domain. Since SL is still in its infancy and the academic literature on the usage of MUVEs is scarce, this study will help understand the usage of immersive virtual environments in educational contexts.

Third, the study provides a better understanding of hedonic consumption behaviours for measuring or predicting the usage of MUVEs, as the hedonic constructs explained a large amount of variance by the proposed model.

Finally, the study also exposes the inability of traditional technology acceptance approaches such as TAM or TAM2 in explaining the user acceptance of today’s highly interactive, multi-user and entertainment-oriented technologies. This has raised a very vital question about TAM’s future, as it loses its ability to be used as a tool to benchmark modern day technologies.

### 7.4.2 Research and practical implications

The implications of this research for educators and researchers are multi-fold. The educators of SL should include elements of enjoyment, arousal and emotional involvement while designing academic activities in order to enhance the usage of SL among students. The more the students enjoy the virtual environment, get emotionally involved and aroused, the more likely they will accept and use it and ultimately enhance their learning. Such experiences are illustrated in practice by more popular islands in SL such as the *Genome Island*[^14] and several others[^15]. Here, students are presented with

opportunities to enjoy, co-create, role play and be involved in a real time educational process. This presents students with a richer and rewarding learning experience. All these aspects will help users of SL to be more involved and engaged in educational activities.

For researchers of technology acceptance, hedonic consumption behaviours especially emotional responses should be given due consideration while measuring the usage of entertainment-oriented technologies such as MUVEs or multi-player online games. The proposed model presented in this study can also be used as a baseline to further investigate the acceptance of other MUVEs. The inclusion of other behavioural factors such as sense of presence, flow, critical mass, social pressures and playfulness would help predict user acceptance of MUVEs more accurately.

### 7.4.3 Limitations

This study has the following limitations: First of all, the study sample may be biased as the respondents were more likely to be engaged with the SL environment than non-respondents. Therefore, respondents could have been captured to the ‘hedonic consumption behaviours’. Secondly, the study results may not be generalised to other MUVEs because the sample represents users of SL only. Finally, the issue of self-reported data might have caused common method bias (CMB) in the study. However, the results of Harman’s single factor test revealed that the impact of CMB was not significant in our study. The complete details of un-rotated factor analyses are presented in Appendix J.

### 7.5 Summary

The study provided a useful insight into user acceptance of SL in the educational context. Instead of focusing on the traditional motivational and performance-based

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determinants of technology acceptance, this study focused on the hedonic consumption behaviours because the underlying technology (Second Life) possessed a large social and entertainment element. An extended technology acceptance model (TAM2) was presented and later empirically validated. Findings suggest that hedonic consumption behaviours especially emotional responses explained a significant amount of users’ intentions to use SL. The study also helped in exposing the inability of traditional technology acceptance approaches (like TAM or TAM2) to predict the usage of today’s highly interactive, multi-user and entertainment-oriented technologies. This is in line with some previous studies but needs more investigation, by conducting similar studies with other multi-user virtual environments, before reaching a verdict on their acceptance. Although hedonic consumption behaviours explained a significant amount of users’ intentions to use SL, more research would be needed to explore other key usage behaviours in order to better explain the usage of MUVEs in the educational contexts and to utilise them as effective teaching and learning tools.
8 Conclusion and Future Work

This chapter presents the summary of the thesis. The research aims laid down in Chapter 1 are revisited in this chapter. The key contributions made by this thesis are also presented along with the ideas for future research.

8.1 Summary of the thesis

The research objectives presented in this thesis were aimed at investigating effective ways of integrating Web 2.0 technologies in unit teaching and examining user acceptance of Web 2.0 technologies in higher education. These objectives were met by conducting case studies and survey studies involving some popular Web 2.0 technologies (blog, social bookmarks, podcast and Second Life) and performing empirical investigation of their user acceptance in higher education settings. The thesis was organised as follows:

- Chapter 1 set up the tone of the thesis by defining key concepts to be investigated in the later chapters. The definition of e-learning was presented and the role of Web and Web-based technologies in the practice of e-learning was explained. The notion of Web 2.0 and associated technologies was also introduced along with their potential benefits and drawbacks in educational context. Chapter 1 presented the research problems addressed in this thesis, the aims of the research and the structure of the thesis.

- Chapter 2 formed the theoretical base of the thesis. A detailed overview of the key learning theories was presented and the concept of student-centred learning was explained in the light of various learning theories. The concepts of individual learning styles and associated learning style theories / models were
also explained. The definition of e-learning was re-visited and the importance of Web and Web 2.0 technologies in the practice of e-learning was highlighted. The challenges of using Web 2.0 technologies and their low penetration rates in education were discussed, which led to the discussion of technology acceptance theory and an overview of the existing technology acceptance models from Information Systems research. The above mentioned literature review helped in highlighting the problem areas and gaps found in the practice of e-learning in higher education, especially in the integration of Web 2.0 technologies in unit teaching. It also highlighted the need to examine user acceptance of Web 2.0 technologies in higher education and to explore key determinants of Web 2.0 usage.

- Chapter 3 discussed the research methodologies adopted in this thesis. The research objectives presented in Chapter 1 necessitated exercising of case study and survey study approaches in order to investigate the integration and user acceptance of Web 2.0 technologies in higher education context. Chapter 3 presented the detailed design of the two case studies about integrating a combination of Web 2.0 technologies (a unit blog, a social bookmarks page and series of lecture podcasts) in unit teaching. The chapter also presented the detailed design of the two survey studies about user acceptance of some popular Web 2.0 technologies (blog, podcast and Second Life) in higher education.

- Chapter 4 presented findings of the two case studies that were conducted to address the first research objective of this thesis, i.e., *how to effectively integrate Web 2.0 technologies in higher education settings*. A total of 120 students from an introductory Web programming unit at Swinburne University of Technology participated in the study. The study started with the collection of students’ learning styles and technology preference data (using an online questionnaire) which were later used to integrate a unit blog, a social bookmarks page and series of lecture podcasts in a Web programming unit based on the match between students’ learning styles and technology preferences. A feedback questionnaire was used at the end of the study to highlight the key strengths and shortcomings of the study. The study outcomes were encouraging in terms of
Web 2.0 usage and highlighting significant relationships among learning styles and technology preferences of the current generation. The adopted approach also helped in achieving the well-balanced academic performances across all learner types in the unit. The second case study was conducted in an advanced Web programming unit with a total of 161 students; majority of them also participated in the first case study. The follow-up study replicated the results of the first case study in terms of findings significant relationships; user satisfaction toward usage of incorporated technologies; and achievement of well balanced academic performances across various learner types, thus strengthened the student-centred approach for successful integration of Web 2.0 technologies in academia. Chapter 4 also presented a detailed discussion on the key findings of the two case studies and its implications for educators and practitioners of Web 2.0 technologies.

Chapter 5 presented the findings of an empirical study that was aimed at addressing the second research objective of the thesis, i.e., exploring key determinants and user acceptance of Web 2.0 technologies in higher education. Keeping in mind the student-centred approach and based on Davis’s technology acceptance model (TAM) and Kirton’s adaptive-innovative (KAI) theory of cognitive styles, an extended TAM was presented to examine the effect of students’ cognitive style on user acceptance of two prominent Web 2.0 technologies, blog and podcast. Students of a large Web programming unit at Swinburne University of Technology participated in an online survey which resulted in 187 valid responses. The empirical evaluation was conducted in PLS (partial least squares) which provided good support to the proposed model and hypotheses. The study provided a useful insight into user acceptance of blogs and podcasts and how students with different cognitive styles perceive technology. The study findings confirmed that students with innovative cognitive style perceive technology more useful and easy-to-use as compared to their adaptor counterparts and should be used as a catalyst for technology dissemination or adoption in a classroom setting.
Chapter 6 also addressed the second research objective in terms of exploring the significant predictors of Web 2.0 usage in academia. However, the empirical study presented in Chapter 6 was focused on examining the media richness of blogs and podcasts and its impact on user acceptance of the two technologies. A theoretical model was presented based on TAM and media richness theory (MRT). The data for this study was also collected during the first survey study presented in Chapter 5. The empirical evaluation in PLS provided good support to the proposed model / hypotheses and highlighted the significant influence of media richness construct on user acceptance of blogs and podcasts. However, the study findings defied the dominance of rich medium (audio/video-based podcast) over lean medium (text-based blog) in explaining user acceptance of blogs and podcasts. The diverse influence of media richness on usage intentions of different technologies triggered the need for more research on comparing media richness of Web 2.0 technologies.

Chapter 7 advanced the research on academic usage of Web 2.0 technologies by examining user acceptance of another popular Web 2.0 technology, Second Life (a 3-D multi-user virtual environment). Instead of focusing on the traditional motivational and performance-based determinants of technology acceptance, this study emphasised on hedonic consumption behaviours because of the hedonic nature of Second Life. The study presented an extended TAM to examine the effect of emotional and imaginative responses of hedonic consumption behaviours on user acceptance of Second Life. The data was collected through an online survey using in-world (within Second Life) and external resources (list serves). A total of 122 valid responses were gathered from academic-centric participants (students, teachers, researchers and academic managers) within Australia and elsewhere. The empirical evaluation of the proposed model confirmed the highly significant effect of emotional responses on usage intentions of Second Life. The study findings also exposed the inability of traditional technology acceptance approaches (such as TAM) in explaining user acceptance of today’s highly interactive, multi-user and entertainment-oriented technologies such as Second Life.
8.2 Key contributions of this thesis

This thesis made several contributions as discussed below:

- **First**, it provided an overview of the prominent learning theories which further helped in understanding the concept of student-centred learning. The concept of e-learning was explained and significance of Web technologies in the practice of e-learning was highlighted. The thesis also explained the notion of Web 2.0 and its credence in academia.

- **Second**, the thesis advanced the e-learning literature by integrating Web 2.0 technologies in unit teaching based on the match between students’ learning style and technology preferences. A number of statistically significant relationships between the two constructs were also highlighted.

- **Third**, the thesis contributed toward the practice of Web 2.0 technologies in higher education. The two case studies presented in Chapter 4 helped in integrating a combination of blog, social bookmarks page and podcasts in unit teaching based on the student-centred approach. The use of incorporated technologies yielded higher satisfaction levels from study participants and well-balanced performances across all learner types.

- **Fourth**, this thesis advanced the literature of technology acceptance by formulating technology acceptance models for Web 2.0 technologies. Because of the infancy of Web 2.0 technologies, the academic literature on user acceptance of Web 2.0 technologies is scarce. This thesis contributed to the field of e-learning and Information Systems by conducting empirical studies on user acceptance of some prominent Web 2.0 technologies such as blogs, podcasts and Second Life. The thesis also advanced the literature on technology acceptance by exploring key determinants of Web 2.0 usage. For example, effect of cognitive styles and media richness constructs on user acceptance of blogs and podcasts; and, effect of hedonic consumption behaviours on user acceptance of Second Life. Moreover, exposing the inability of traditional technology
acceptance approaches (such as TAM) in explaining the user acceptance of highly interactive, multi-user and entertainment oriented technologies (like Second Life) is another significant contribution of this thesis.

- A minor contribution of the thesis is that it corroborated the significance of PLS approach in analysing structural models involving multiple constructs and multiple indicators.

### 8.3 Future work

There are few improvements which could further strengthen the outcomes of the case studies reported in this thesis.

- Although integrating a combination of Web 2.0 technologies in unit teaching resulted in fitting user response and well-balanced academic performances across all learner types, comparative studies with students from non-scientific background would strengthen the case study outcomes presented in Chapter 4.

- The significant relationships observed among various learner types could help in the formation of appropriate groupings for group projects / assignments. Such an experience could be implemented in the online offerings of units as effective collaboration is even more daunting in virtual environments. Future studies on comparing the performance of matched and unmatched learner groups would make significant contributions towards collaborative or community research in academia.

- The various technologies being investigated have non-equivalent functions (e.g., podcasts convey lecture material while blogs provide for public exchange). Therefore a comparison between learners’ style and usage of functionally-equivalent technologies would be a useful extension to this thesis.
Chapter 8: Conclusion and Future Work

- The field of technology acceptance is one of the most researched field in IS but investigation of Web 2.0 usage is fairly new mainly because of the infancy of Web 2.0 technologies especially in academia. Thus, in addition to the contributions made by this thesis toward user acceptance of Web 2.0 technologies, several improvements in the studies reported here and further research would help predict usage of Web 2.0 more accurately:

- The study reported in Chapter 5 demonstrated the effect of adaptive and innovative cognitive styles on user acceptance of blogs and podcasts. Future studies exploring other cognitive style dimensions such as systematic - heuristic or field dependent - field independent would help understand the effect of other personality traits on user acceptance of blogs and podcasts. Future studies involving other Web 2.0 technologies such as wikis, Twitter and Second Life would also help compare the usage patterns of various cognitive styles. Finally, a comparative analysis of various personality traits against various Web 2.0 technologies would add more substance to this field of research.

- The study reported in Chapter 6 demonstrated the significant impact of media richness on user acceptance of blogs and podcast but provided little support to media richness theory because the lean medium (text-based blog) had relatively stronger influence on user acceptance as compared to the rich medium (audio/video-based podcast). Future comparative studies involving other media types such as wikis (lean) and Second Life (rich) would help understand this phenomenon in a better way and contribute towards the ongoing debate on conflicting role of media richness theory on decision making or task performance.

- The studies reported in Chapters 5 and 6 emphasised only on the effect of external variables (cognitive styles and perceived media richness) on user acceptance of blogs and podcast. Future studies exploring other determinants of blog and podcast usage would improve our ability to predict usage intentions of blogs and podcasts more accurately and increase their usage in academia.
The study reported in Chapter 7 demonstrated a huge influence of hedonic consumption behaviours (in terms of emotional responses) on usage intentions of Second Life. Similar studies with other multi-user virtual environments such as Habbo Hotel, There or Sims would help compare the hedonic consumption of various virtual worlds. At the same time, there is also a need to further investigate other behavioural factors that could help predict user acceptance of Second Life more accurately. Finally, as Swinburne has also got its virtual campus in Second Life, future offerings of online units through this virtual setting and comparing academic performances of users and non-users of Second Life would also help evaluate the performance of this emerging virtual environment in academia.

Another possible extension of the thesis would be about analysing the effect of various age groups on user acceptance of Web 2.0 technologies.
Bibliography


Bibliography


Appendices

Appendix A: Form of Disclosure and Informed Consent

Project Title

‘Using E-learning Modalities to Incorporate Learning Styles into Unit Design’

Principal Investigators

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Project Introduction

Every person perceives things in a different manner thus possess a different learning style. In academic settings, students learn in a variety of methods but each student has a preferred learning style. Some students tend to focus on facts, data and algorithm; others are more comfortable with theories and mathematical models. Some conceive more from visual information like pictures, diagrams and simulations; others get more from spoken and written information. Some prefer interactive learning; others learn well individually. Learning styles affect how students approach new material and existing studies show significant relationships between students’ learning styles and academic performances. Existing research shows that exposure to varying learning styles could help improve students’ academic performance and help them becoming a life-long learner.

The goal of this research is to incorporate students’ learning styles into unit design using emerging e-learning technologies such as blog, wiki, Instant Messenger (IM),
podcast, vodcast and social bookmarks. We aim to introduce a range of e-learning technologies into our programming units based on students’ preferred learning styles. These technologies will be used to support students’ preferred learning styles. For example, podcast (audio recording) of a lecture would be useful for ‘verbal’ learners while vodcast (video recording) for ‘visual’ learners. Similarly, ‘active’ learners would use blogs and wikis more often than their ‘reflective’ class mates. However, by introducing a combination of these technologies we encourage students to experience their non-preferred means of learning to broaden their range of learning styles, thus become a life-long learner. This research aims at partly satisfying the requirements of a PhD degree.

User Participation

As a participant in this research, you will be asked to complete an online questionnaire in the form of Felder-Soloman’s Index of Learning Style (ILS) which comprises of 44 questions, each question carrying 2 responses. After submitting the ILS questionnaire, you will receive an automatic feedback response about your preferred learning styles. We will use this data to see the impact of preferred learning styles on your academic performance form the previous semester. Based on these results, a combination of some of the above mentioned e-learning technologies will be introduced into your current programming unit to support preferred learning styles and to broaden your range of learning styles. This will help you understand all types of learning material presented in this unit.

We are also interested to know about your current experience and preferences of the above mentioned e-learning technologies and therefore request you to complete another online questionnaire (comprising of 14 questions). This data will be used to correlate you preferred learning styles with your preferred e-learning technologies. At the completion of this unit, you will be asked to provide your feedback on the above experiments using a feedback questionnaire (comprising of 41 questions). The aim of the feedback questionnaire is to see how well these e-learning technologies were incorporated into that unit and what impact did they make on your preferred learning styles and academic performance.

Participants Rights and Interests

The participation in this research is purely on volunteer basis. Therefore as a participant in this research you may stop at any time, you may withdraw at any time, there is no deception involved and your answers will be kept confidential. Your decision to participate or not to participate in this study will have no effect on your class activities or academic performance. As a participant, your performance in this study will in no
way affect your academic program performance. Your personal details, academic
records and individual performances in this study will not be revealed to any other
person or organisation and will not be identified in any research publications that may
arise from this study.

Any questions regarding this project titled above can be directed to the Principal
Investigator, Professor Yun Yang, of the Faculty of ICT on telephone number (03) 9214
8752 or to Mr. Nauman Saeed, of the Faculty of ICT on telephone number (03) 9214
4748.

Privacy & Confidentiality

Survey data and personal records will be stored on protected databases hosted on a
secure Web server in the Faculty of ICT. This data will not be accessible to other users
of the Web server and will be securely retained with the principal investigator after the
completion of the study. The analysed results may appear in research publications but
complete anonymity will be observed and individuals will not be identified. If a person
or an individual performance needs to be published, a prior permission will be sought
from the participant.

Complaint Procedure

This project has been approved by or on behalf of the Swinburne’s Human Research
Ethics Committee (SUHREC) in line with the national statement on Ethical Conduct in
Research Involving Humans. If you have any concerns or complaints about the conduct
of this project, you can contact:

Research Ethics Officer, Office of Research & Graduate Studies (H68),
Swinburne University of Technology, P O Box 218, HAWTHORN VIC 3122.
Tel (03) 9214 5218 or +61 3 9214 5218 or resethics@swin.edu.au
Informed Consent

1. I consent to participate in the project named above, the particulars of which have been explained to me.

2. Please select your responses to the following:
   - I agree to make myself available for further information if required.
     Yes ☐ No ☐
   - I agree to complete questionnaires asking me about the project “Using E-learning Modalities to Incorporate Learning Styles into Course Design”.
     Yes ☐ No ☐

3. I acknowledge that:
   - My participation is voluntary and that I am free to withdraw from the project at any time without explanation;
   - The project is for the purpose of research and not for profit;
   - My personal and academic information will be collected and retained for the purpose of carrying out this project only;
   - My personal and academic information will be accessed and analysed by the researcher(s) for the purpose of conducting this project only;
   - My anonymity is preserved and I will not be identified in publications otherwise without my express written consent.
   - My performance in the study will have no effect on my academic program performance or class activities.

By clicking on “Agree” button below you agree to participate in this project.
Confirmation (email) of Ethics Clearance

----- Forwarded message from Leah Cattanach <LCattanach@groupwise.swin.edu.au> - ----

Date: Wed, 31 Jan 2007 14:18:13 +1100
From: Leah Cattanach <LCattanach@groupwise.swin.edu.au>
Reply-To: Leah Cattanach <LCattanach@groupwise.swin.edu.au>
Subject: SUHREC - Ethics Project 0607/107 - Ethics Clearance
To: yyang@swin.edu.au
To: Prof. Yun Yang, Faculty of Information Technologies.

SUHREC - Prof. 0607/107 - Using E-Learning Modalities to Incorporate Learning Styles into Unit Design.
Researchers: Prof. Yun Yung, Mr Nauman Saeed
Duration: Approved to 31 December 2007.

I refer to the revisions to your ethical clearance application for the above project as submitted to the Chair of SHESC2 (H&B-B) or delegated member (on 25 January 2007) for expedited ethical review.

I am pleased to advise that approval has now been given for the project to proceed in line with standard ethics clearance conditions here outlined:

- All human research activity undertaken under Swinburne auspices must conform to Swinburne and external regulatory standards, including the current National Statement on Ethical Conduct in Research Involving Humans and with respect to secure data use, retention and disposal.

- The named Swinburne Chief Investigator / Supervisor remains responsible for any personnel appointed to or associated with the project being made aware of ethics clearance conditions, including research and consent procedures or instruments approved. Any change in Chief investigator / supervisor requires timely notification and SUHREC endorsement.

- The above project has been approved as submitted for ethical review by or on behalf of SUHREC. Amendments to approved procedures or instruments ordinarily require prior ethical appraisal / clearance. SUHREC must be notified immediately or as soon as possible thereafter of (a) any serious or unexpected adverse effects on participants and any redress measures; (b) proposed changes to protocol; and (c) unforeseen events which might effect continued ethical acceptability of the project.

- At a minimum, an annual report on the progress of the project is required as well as at the conclusion (or abandonment) of the project.
- A duly authorised external or internal audit of the project can be undertaken at any time.

Please contact me if you have any enquiries or concerns about on-going ethics clearance. The SUHREC project number should be cited in communication.

Best wishes for Nauman Saeed's project.

Yours sincerely,

Leah Cattanach  
Secretary, SHESC2  
Marketing Coordinator  
Faculty of Life and Social Sciences  
Swinburne University of Technology  
PO Box 218, Hawthorn 3122  
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Appendix B: Index of Learning Styles (ILS)* Questionnaire

DIRECTIONS

Enter your answers to every question on the ILS scoring sheet. Please choose only one answer for each question. If both “a” and “b” seem to apply to you, choose the one that applies more frequently.

1. I understand something better after I
   a) try it out
   b) think it through

2. I would rather be considered
   a) realistic
   b) innovative

3. When I think about what I did yesterday, I am most likely to get
   a) a picture
   b) words

4. I tend to
   a) understand details of a topic but may be fuzzy about its overall structure
   b) understand the overall structure but may be fuzzy about details

5. When I am learning something new, it helps me to
   a) talk about it
   b) think about it

6. If I were a lecturer, I would rather teach a unit
   a) that deals with facts and real life situations
   b) that deals with ideas and theories

7. I prefer to get new information in
   a) pictures, diagrams, graphs, or maps
   b) written directions or verbal information

8. Once I understand
   a) all the parts, I understand the whole thing
   b) the whole thing, I see how the parts fit
9. In a study group working on difficult material, I am more likely to
   a) jump in and contribute ideas
   b) sit back and listen

10. I find it easier
    a) to learn facts
    b) to learn concepts

11. In a book with lots of pictures and charts, I am likely to
    a) look over the pictures and charts carefully
    b) focus on the written text

12. When I solve math problems
    a) I usually work my way to the solutions one step at a time
    b) I often just see the solutions but then have to struggle to figure out the steps to
get to them

13. In classes I have taken
    a) I have usually gotten to know many of the students
    b) I have rarely gotten to know many of the students

14. In reading non-fiction, I prefer
    a) something that teaches me new facts or tells me how to do something
    b) something that gives me new ideas to think about

15. I like teachers
    a) who put a lot of diagrams on the board
    b) who spend a lot of time explaining

16. When I’m analysing a story or a novel
    a) I think of the incidents and try to put them together to figure out the themes
    b) I just know what the themes are when I finish reading and then I have to go
back and find the incidents that demonstrate them

17. When I start a homework problem, I am more likely to
    a) start working on the solution immediately
    b) try to fully understand the problem first

18. I prefer the idea of
    a) certainty
    b) theory

19. I remember best
    a) what I see
    b) what I hear

20. It is more important to me that a lecturer
    a) lay out the material in clear sequential steps
b) give me an overall picture and relate the material to other units#

21. I prefer to study
   a) in a study group
   b) alone

22. I am more likely to be considered
   a) careful about the details of my work
   b) creative about how to do my work

23. When I get directions to a new place, I prefer
   a) a map
   b) written instructions

24. I learn
   a) at a fairly regular pace. If I study hard, I’ll “get it”
   b) in fits and starts. I’ll be totally confused and then suddenly it all “clicks”

25. I would rather first
   a) try things out
   b) think about how I’m going to do it

26. When I am reading for enjoyment, I like writers to
   a) clearly say what they mean
   b) say things in creative, interesting ways

27. When I see a diagram or sketch in class, I am most likely to remember
   a) the picture
   b) what the lecturer# said about it

28. When considering a body of information, I am more likely to
   a) focus on details and miss the big picture
   b) try to understand the big picture before getting into the details

29. I more easily remember
   a) something I have done.
   b) something I have thought a lot about

30. When I have to perform a task, I prefer to
   a) master one way of doing it
   b) come up with new ways of doing it

31. When someone is showing me data, I prefer
   a) charts or graphs
   b) text summarising the results

32. When writing a paper, I am more likely to
   a) work on (think about or write) the beginning of the paper and progress forward
b) work on (think about or write) different parts of the paper and then order them

33. When I have to work on a group project, I first want to  
   a) have “group brainstorming” where everyone contributes ideas  
   b) brainstorm individually and then come together as a group to compare ideas

34. I consider it higher praise to call someone  
   a) sensible  
   b) imaginative

35. When I meet people at a party, I am more likely to remember  
   a) what they looked like  
   b) what they said about themselves

36. When I am learning a new topic*, I prefer to  
   a) stay focused on that topic*, learning as much about it as I can  
   b) try to make connections between that topic* and related topics*  

37. I am more likely to be considered  
   a) outgoing  
   b) reserved

38. I prefer units* that emphasise  
   a) concrete material (facts, data)  
   b) abstract material (concepts, theories)

39. For entertainment, I would rather  
   a) watch television  
   b) read a book

40. Some lecturers start their lectures with an outline of what they will cover. Such outlines are  
   a) somewhat helpful to me  
   b) very helpful to me

41. The idea of doing homework in groups, with one grade for the entire group,  
   a) appeals to me  
   b) does not appeal to me

42. When I am doing long calculations,  
   a) I tend to repeat all my steps and check my work carefully  
   b) I find checking my work tiresome and have to force myself to do it

43. I tend to picture places I have been  
   a) easily and fairly accurately  
   b) with difficulty and without much detail

44. When solving problems in a group, I would be more likely to  
   a) think of the steps in the solution process
b) think of possible consequences or applications of the solution in a wide range of areas


# American terminologies are replaced with Australian terminologies
Appendix C: Tools Preference Questionnaire

SECTION I: Demographics

1. What is your age _______ (in years)?

2. What is your gender?
   a) male
   b) female

3. How many hours do you use the Internet per week?
   a) 5-10 hours
   b) 10-15
   c) 15-20
   d) more than 20 hours

4. For what purpose do you use Internet mostly?
   a) study
   b) work
   c) personal
   d) entertainment
   e) others

SECTION II: Technology preferences

Please read through the following statements and decide how much you prefer to use each of these technologies to perform the following academic activities. Using the scale provided write the number that best indicates how you feel on the space provided before each statement (please enter only digits from 1 to 5).

Least preferred    1    2    3    4    5     Most preferred

1. I would prefer to revise lecture online by:
   a) _____listening to podcast (audio) of the lecture
   b) _____watching vodcast (video) of the lecture
   c) _____discussing it on the course blog
   d) _____discussing it on the course wiki
   e) _____discussing it with my peers on IM
f) _____discussing it with my peers through email
g) _____discussing it with my peers through Blackboard

2. I would prefer to submit online a group project to lecturer:
   a) _____as a podcast presentation
   b) _____as a vodcast presentation
   c) _____through course blog
   d) _____through course wiki
   e) _____through IM
   f) _____through email
   g) _____through Blackboard

3. I would prefer to have online class discussion with lecturer through:
   a) _____podcast
   b) _____vodcast
   c) _____course blog
   d) _____course wiki
   e) _____IM
   f) _____email
   g) _____Blackboard

4. I would prefer to have online group discussion through:
   a) _____podcast
   b) _____vodcast
   c) _____course blog
   d) _____course wiki
   e) _____IM
   f) _____email
   g) _____Blackboard

5. I would prefer to have online study discussion with a friend through:
   a) _____podcast
   b) _____vodcast
   c) _____course blog
   d) _____course wiki
   e) _____IM
   f) _____email
   g) _____Blackboard

6. I would prefer my lecturer to conduct virtual office hours through:
   a) _____podcast
   b) _____vodcast
   c) _____course blog
   d) _____course wiki
   e) _____IM
   f) _____email
   g) _____Blackboard
7. I would prefer to receive assignments online from lecturer through:
   a) _____ podcast
   b) _____ vodcast
   c) _____ course blog
   d) _____ course wiki
   e) _____ IM
   f) _____ email
   g) _____ Blackboard

SECTION III: Open-ended questions

The following section contains some open-ended questions about your opinion on usage of Web 2.0 technologies in higher education.

1. Can you suggest some potential uses of blogs /wikis in higher education?
   _______________________________________________________

2. Can you suggest some potential uses of podcasts / vodcasts in higher education?
   _______________________________________________________

3. Can you suggest some potential uses of social bookmarks in higher education?
   _______________________________________________________


Appendix D: Feedback Questionnaire

Please enter your age (in numbers) ____________

Please select your gender: ________Male ________Female

Section I: Please answer the following questions regarding your experience with the unit blog 'Swinblog':

1. How many times (on average) you accessed Swinblog per week?
   a) not every week
   b) 1-2 times
   c) 3-5 times
   d) 6-10 times
   e) more than 10 times

2. How often did you respond to the weekly minute papers?
   a) never
   b) 1-3 times
   c) 4-6 times
   d) 7-9 times
   e) 10-12 times

3. How often did you post answers to students’ queries throughout the semester?
   a) never
   b) once
   c) twice
   d) 3-5 times
   e) 6-10 times
   f) more than 10 times

Please read through the following statements and place a check mark indicating your level of agreement or disagreement from 1 = ‘Strongly Agree’ through 7 = ‘Strongly Disagree’

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

4. I like the idea of using 'Minute Paper' on Swinblog.
Appendix D

5. I like the idea of posting answers to other students’ queries on Swinblog.

6. The answers posted by the fellow students helped me understand the lecture contents.

7. The answers posted by the students sometimes confused me for what I have learnt in the lecture about the same topic.

8. When I posted an answer to a query, I improved my own understanding of the subject.

9. Swinblog helped in improving the collaboration among students.

10. Swinblog helped in improving the collaboration among students and lecturer(s).

11. Feedback of the 'Minute Paper' improved lecturer’s performance in the class.

12. I preferred to be anonymous when posting comments on Swinblog.


14. I would prefer to use 'Discussion Board' in Blackboard than using Swinblog.

15. I would prefer to use the blog integrated within Blackboard than using Swinblog.

16. Overall, I’m satisfied with the use Swinblog in this unit.

17. Can you give some suggestions to improve Swinblog?

18. Can you suggest some features you would like to see in the future Swinblog?

SECTION II: Please answer the following questions regarding your experience with the unit bookmarks page 'Swinbookmark'
1. How often (on average) you accessed Swinbookmark per week?
   a) not every week
   b) 1-2 times
   c) 3-5 times
   d) 6-10 times
   e) more than 10 times

2. How many bookmarks did you post on Swinbookmark throughout the semester?
   a) none
   b) one
   c) two
   d) 3-5
   e) 6-10
   f) more than 10

Please read through the following statements and place a check mark indicating your level of agreement or disagreement from 1= ‘Strongly Agree’ through 7 = ‘Strongly Disagree’

3. I like the idea of contributing bookmarks on Swinbookmark.

4. I preferred to be anonymous when posting bookmarks on Swinbookmark.

5. My identity on Swinbookmark hindered my participation.


7. Swinbookmark helped in improving collaboration among students and lecturer(s).

8. Overall, I’m satisfied with the use of Swinbookmark in this unit.

9. Can you give some suggestions to improve Swinbookmark?

   __________________________________________________________

10. Can you suggest some features you would like to see in the future unit bookmarks?

   __________________________________________________________
SECTION III: Please answer the following questions regarding your experience with the lecture podcasts / vodcasts

1. How often did you access lecture podcast/vodcast throughout the semester?
   a) never
   b) 1-3 times
   c) 4-6 times
   d) 7-9 times
   e) 10-12 times

2. How often did you download lecture podcast/vodcast throughout the semester?
   a) never
   b) 1-3 times
   c) 4-6 times
   d) 7-9 times
   e) 10-12 times

3. Your most preferred way to access podcasts was:
   a) live streaming (listening podcast on Lectopia website)
   b) download (manual download to your PC)
   c) subscribe to Lectopia website (automatic download to your PCs)

4. Did you download and listen to the podcasts on your portable devices (MP3 / MP4 players, iPod, PDA, mobile phone)?
   a) yes
   b) no

5. How much you preferred to use the following devices for listening/watching to lecture podcasts/vodcasts? Using the scale provided write the number that best indicates how you feel on the text box next to each statement (please enter only digits from 1 to 7).

   least preferred  1  2  3  4  5  6  7  most preferred

   ___ iPod
   ___ portable MP3 players (other than iPod)
   ___ mobile phone
   ___ PDA
   ___ desktop PC
   ___ laptop PC

6. Where did you mostly use the portable devices to listen/watch the podcasts/vodcast?
   a) while commuting to or from the campus
   b) during the lecture
   c) at the gym
   d) at home
   e) others
7. What factors helped your learning with the podcasts/vodcast?

8. What factors hindered your learning with the podcasts/vodcast?

9. Can you give some suggestions to improve our future podcasts/vodcast?

_________________________________________________________________________

10. What would you prefer to use in your future units?
   a) podcast of the lecture
   b) vodcast of the lecture

   Why? (please specify) _______________________

Please read through the following statements and place a check mark indicating your level of agreement or disagreement from 1= ‘Strongly Agree’ through 7 = ‘Strongly Disagree’

11. The availability of podcasts/vodcast affected my attendance in the lecture?

12. I would prefer to listen to lecture podcast or watch the lecture at my convenient time than attending the lecture?

13. Overall, I am satisfied with the use of podcasts/vodcast in this unit.
Appendix E: Form of Disclosure and Consent Information Statement

Project Title

“User Acceptance of Web 2.0 Technologies in Higher Education”

Principal Investigators

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Project Introduction

The aim of this project is to investigate the user acceptance of emerging Web 2.0 technologies such as blogs, podcasts and Second Life (a 3-D virtual environment) in educational settings. The study aims at exploring students’ usage behaviour towards Web 2.0 technologies as well as highlighting significant predictors of such usage in order to understand and ultimately enhance the usage of Web 2.0 technologies. This research aims at partly satisfying the requirements of a PhD degree.

User Participation

As a participant in this research, you will be asked to complete an anonymous online questionnaire. These questions are related to your experience with the Web and Web 2.0 technologies such as blogs, podcasts and Second Life; your preferred learning styles; and your involvement and motivation towards using Web 2.0 technologies. The resulting data will be used to analyse the usage behaviour towards Web 2.0 technologies.
and highlight the significant predictors of such usage. Your completion and submission of the questionnaire implies consent on your part.

**Participants Rights and Interests**

Anonymous participation in this research is purely on volunteer basis. Therefore as a participant in this research you may stop prior to submission. There is no deception involved and your answers will be kept confidential. Your decision to participate or not to participate in this study will have no effect on your class activities or academic performance. Your participation (or not) in this project will in no way affect your relationship with Swinburne nor have any bearing on your academic progress.

Any questions regarding this project titled above can be directed to the Principal Investigator, Professor Yun Yang, of the Faculty of ICT on telephone number (03) 9214 8752, to Mr. Nauman Saeed, of the Faculty of ICT on telephone number (03) 9214 4751 or to Dr Suku Sinnappan, of the Faculty of Higher Education on telephone number (03) 9215 7192.

**Privacy & Confidentiality**

Survey data will be stored on protected databases hosted on a secure Web server in the Faculty of ICT. This data will not be accessible to other users of the Web server and will be securely retained with the principal investigator after the completion of the study. The analysed results may appear in research publications but complete anonymity will be observed and individuals will not be identified.

**Complaint Procedure**

This project has been approved by or on behalf of the Swinburne’s Human Research Ethics Committee (SUHREC) in line with the national statement on Ethical Conduct in Research Involving Humans. If you have any concerns or complaints about the conduct of this project, you can contact:

Research Ethics Officer, Swinburne Research (H68),
Swinburne University of Technology, P O Box 218, HAWTHORN VIC 3122.
Tel (03) 9214 5218 or +61 3 9214 5218 or resethics@swin.edu.au

**Informed Consent**

1. I have read and understood the project/consent information statement.
2. I acknowledge that this project is for the purpose of research and not for profit;

By clicking on “Agree” button below I agree to participate in this project.
Confirmation (email) of Ethics Clearance

To: Prof Yun Yang/Mr Nauman Saeed, FICT

Dear Yun and Nauman

SUHREC Project 0708/220 User Acceptance of Emerging Web Technologies in Higher Education
Prof Y Yang FICT Mr Nauman Saeed
Proposed duration: 15/05/2008 To 15/05/2009

I refer to the ethical review of the above project protocol undertaken on behalf of Swinburne's Human Research Ethics Committee (SUHREC) by a SUHREC Subcommittee (SHESC1). Your responses to the review, as emailed today with attachments, were put to a delegate of the SUHREC Subcommittee for consideration.

I am pleased to advise that approval for the project to proceed has been given as submitted to date in line with standard on-going ethics clearance conditions here outlined.

- All human research activity undertaken under Swinburne auspices must conform to Swinburne and external regulatory standards, including the National Statement on Ethical Conduct in Human Research and with respect to secure data use, retention and disposal.

- The named Swinburne Chief Investigator/Supervisor remains responsible for any personnel appointed to or associated with the project being made aware of ethics clearance conditions, including research and consent procedures or instruments approved. Any change in chief investigator/supervisor requires timely notification and SUHREC endorsement.

- The above project has been approved as submitted for ethical review by or on behalf of SUHREC. Amendments to approved procedures or instruments ordinarily require prior ethical appraisal/ clearance. SUHREC must be notified immediately or as soon as possible thereafter of (a) any serious or unexpected adverse effects on participants and any redress measures; (b) proposed changes in protocols; and (c) unforeseen events which might affect continued ethical acceptability of the project.

- At a minimum, an annual report on the progress of the project is required as well as at the conclusion (or abandonment) of the project.

- A duly authorised external or internal audit of the project may be undertaken at any time.
Please contact me if you have any queries about on-going ethics clearance. The SUHREC project number should be quoted in communication.

Best wishes for the project.

Yours sincerely

Keith Wilkins
Secretary, SHESC1
******************************************************************************
Keith Wilkins
Research Ethics Officer
Swinburne Research (H68)
Swinburne University of Technology
P O Box 218
HAWTHORN VIC 3122
Tel +61 3 9214 5218
Fax +61 3 9214 5267
Appendix F: User Acceptance of Blogs and Podcasts - Questionnaire

The questionnaire contains three sections and approximately takes about 15 minutes to complete.

SECTION I:

This section contains questions about your demographics, experience and usage of Internet, Blogs and Podcasts.

1. What is your gender? ________ Male, ________ Female

2. What is your age? ______________ (in years).

3. What is the highest level of education that you have completed?
   - High School
   - TAFE
   - Undergraduate
   - Postgraduate
   - Others:_______

4. How long have you been using Internet?
   - less than 2 years
   - 2-4 years
   - 5-6 years
   - 7-8 years
   - 9 years and more

5. How many times do you use Internet during a week?
   - not at all
   - less than once a week
   - about once a week
   - 2-3 times a week
   - several times a week
   - about once a day
   - several times each day

6. What is your primary place of Internet use?
   - Campus
   - Home
   - Work
   - Others:____________

7. What is your experience with blogs / podcasts?
   - less than 3 months
   - 3-6 months
   - 7-12 months
   - 1-2 years
   - more than 2 years

8. What is your primary place of blogs / podcasts use?
   - Campus
   - Home
   - Work
   - Others:____________
9. What is your primary purpose of using blogs / podcasts?
   - Study
   - Entertainment
   - Work
   - Others: _______________

10. How many times do you use blogs / podcasts during a week?
    - not at all
    - less than once a week
    - about once a week
    - 2-3 times a week
    - several times a week
    - about once a day
    - several times each day

11. How many hours do you use blogs / podcasts every week?
    - not at all
    - 1-5 hours
    - 6-10 hours
    - 11-15 hours
    - 16-20 hours
    - 21-25 hours
    - more than 25 hours

12. How frequently do you use blogs / podcasts?
    - Extremely infrequent
    - Quite infrequent
    - Slight infrequent
    - Neither infrequent nor frequent
    - Slight frequent
    - Quite frequent
    - Extremely frequently

SECTION II:

This section contains 32 questions about your personality type, adopted from Kirton's Adaptive-Innovative personality inventory. Please rate your answers on a scale of 1 (strongly disagree) to 5 (strongly agree), to indicate the degree of agreement with each of the following statements.

Note: Only the highlighted items are used in the final evaluation.

1. I am conventional / traditional
2. I will always think of something when stuck
3. I enjoy detailed work
4. I would sooner create than improve
5. I am prudent (careful/cautious/sensible) when dealing with authority
6. I never act without proper authority
7. I never seek to bend or break the rules
8. I like bosses and work patterns which are consistent
9. I hold back ideas until they are obviously needed
10. I have fresh perspectives on old problems
11. I like to vary set routines at a moment's notice
12. I prefer changes to occur gradually
13. I am a thorough (systematic/careful) person
14. I am a steady plodder (who works with constant and monotonous perseverance)
15. I can cope with several new ideas and problems at the same time
16. I am consistent
17. I am able to stand out in disagreement alone against a group of equals and seniors
18. I am stimulating
19. I readily agree with the team at work
20. I have original ideas
21. I like to master all details painstakingly (carefully/thoroughly)
22. I am able to proliferate (reproduce) ideas
23. I prefer to work on one problem at a time
24. I am methodical and systematic
25. I like to take risks doing things differently
26. I like to work without deviation in a prescribed way
27. I like to impose strict order on matters within own control
28. I like protection of precise instructions
29. I can fit readily into 'the system'
30. I will need the stimulation of frequent change
31. I like colleagues who never 'rock the boat' (cause trouble)
32. I am predictable

SECTION III:

This section contains questions about your perceptions on *Ease-of-Use, Usefulness, Attitude, Behavioural Intention and Media Richness* of blogs and podcasts. Please rate your answers on a scale of 1 (Strongly Disagree) through 7 (Strongly Agree).

**Perceived Ease of Use (PEU)**

PEOU1: Learning to use blog / podcast is easy for me.
PEOU2: I find it easy to get blog / podcast to do what I want it to do.
PEOU3: I find blog / podcast to be flexible to interact with.
PEOU4: It is easy for me to become skilful at using blog / podcast.

**Perceived Usefulness (PU)**

PU1: Using blog / podcast enables me to accomplish my tasks more quickly.
PU2: Using blog / podcast improves my class or work performance.
PU3: Using blog / podcast increases my productivity.
PU4: Using blog / podcast makes it easier for me to understand lecture.
PU5: Using blog / podcast makes it easier for me to communicate with lecturer/friends.
PU6: Overall, I find blog / podcast useful in my study/work

**Attitude (ATD)**

ATD1: Using blog / podcast is a bad/good idea
ATD2: Using blog / podcast is a foolish/wise idea
ATD3: I dislike/like the idea of using blog / podcast
ATD4: Using blog / podcast is unpleasant / pleasant

**Perceived Media Richness (PMR)**

PMR1: Blog / podcast allows me to give and / or receive timely feedback.
PMR2: Blog / podcast allows me to tailor interaction according to my personal requirements.
PMR3: Blog / podcast allows me to communicate a variety of different cues (such as emotional tone, attitude, or formality) during communication.
PMR4: Blog / podcast allows me to use rich and varied language during communication.
Behavioural Intention (BI)

BI1: Assuming I had access to blog / podcast, I intend to use it.
BI2: Given that I had access to blog / podcast, I predict that I would use it.
BI3: I will use blog / podcast frequently in the future.
Appendix G: Un-rotated PCA results for Extended TAM with KAI

The un-rotated factor analyses results are presented in Table G.1 and G.2. Table G.1 gives the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value of 0.823, which is above the threshold value of 0.6 (Pallant, 2005). The Bartlett’s Test of Sphericity value of 0.000 is also significant (i.e., 0.5 or smaller).

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | .823 |
| Bartlett’s Test of Sphericity                   |     |
| Approx. Chi-Square                              | 1788.562 |
| Df                                              | 300 |
| Sig                                             | .000 |

Table G.1: KMO and Bartlett's Test

Table G.2 tells us how many components (factors) can be extracted from the factor analysis. The column named ‘Initial Eigenvalues’ provides the eigenvalues for each component. The column results in six components that have an eigenvalue of 1 or more (Pallant, 2005). These six constructs explain nearly 60% of the variance. However, the final number of factors that can be retained for the study are obtained by comparing the first eigenvalue value from column ‘Initial eigenvalues’ of Table G.2 with the corresponding first value in column ‘Random Eigenvalue’ of Table G.3 (Random eigenvalues are obtained from parallel analyses using ‘Monte Carlo PCA for Parallel Analyses tool). We retain the value if it is greater than the criterion value from parallel analysis and reject it if it is less (Pallant, 2005). The findings of this comparison are summarised in Table G.4 and results in the five factors, the same number of the factors included in our study.

<table>
<thead>
<tr>
<th>Component</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>nt</td>
<td>% of Total</td>
<td>Total</td>
</tr>
<tr>
<td>i 2</td>
<td>2.359</td>
<td>9.436</td>
</tr>
<tr>
<td>n 3</td>
<td>1.966</td>
<td>7.863</td>
</tr>
<tr>
<td>e 4</td>
<td>1.519</td>
<td>6.078</td>
</tr>
<tr>
<td>n 5</td>
<td>1.375</td>
<td>5.499</td>
</tr>
</tbody>
</table>
### Table G.2: Total variance explained

*Note: Extraction Method: Principal Component Analysis.*

<table>
<thead>
<tr>
<th>Eigenvalue #</th>
<th>Random Eigenvalue</th>
<th>Standard Dev</th>
</tr>
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<tbody>
<tr>
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<td>.0620</td>
</tr>
<tr>
<td>2</td>
<td>1.6225</td>
<td>.0543</td>
</tr>
<tr>
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<td>1.5273</td>
<td>.0421</td>
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<td>1.4490</td>
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<td>.0241</td>
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<td>11</td>
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<td>.0213</td>
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<td>.0225</td>
</tr>
<tr>
<td>20</td>
<td>0.6726</td>
<td>.0242</td>
</tr>
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</table>
### Table G.3: Parallel analysis results from ‘Monte Carlo PCA for Parallel Analyses’

*Notes: Number of variables: 25; Number of subjects: 187; Number of replications: 100*

<table>
<thead>
<tr>
<th>Component number</th>
<th>Actual eigenvalue from PCA</th>
<th>Criterion value from parallel analyses</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.601</td>
<td>1.737</td>
<td>Accept</td>
</tr>
<tr>
<td>2</td>
<td>2.359</td>
<td>1.623</td>
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</tr>
<tr>
<td>3</td>
<td>1.966</td>
<td>1.527</td>
<td>Accept</td>
</tr>
<tr>
<td>4</td>
<td>1.519</td>
<td>1.449</td>
<td>Accept</td>
</tr>
<tr>
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<tr>
<td>6</td>
<td>1.144</td>
<td>1.314</td>
<td>Reject</td>
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</table>

### Table G.4: Comparison of eigenvalues from principal component analysis (PCA) and the corresponding criterion values obtained from parallel analysis
Appendix H: Un-rotated PCA results for Extended TAM with MRT

Table H.1 shows the significant values for KMO (.867) and Bartlett’s test (.000).

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin Measure of Sampling Adequacy.</th>
<th>.867</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartlett’s Test of Sphericity</td>
<td>Approx. Chi-Square</td>
</tr>
<tr>
<td></td>
<td>Df</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
</tr>
</tbody>
</table>

Table H.1: KMO and Bartlett’s Test

Table H.2 results in five factors with eigenvalues above 1. The comparison of actual eigenvalues (from Table H.2) and criterion values (from Table H.3) also results in the five factors, which are listed in Table H.4 and matches the same number of factors used in our study.

<table>
<thead>
<tr>
<th>Component</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
</tr>
<tr>
<td>1</td>
<td>7.130</td>
<td>33.951</td>
</tr>
<tr>
<td>2</td>
<td>2.048</td>
<td>9.753</td>
</tr>
<tr>
<td>d 3</td>
<td>1.729</td>
<td>8.235</td>
</tr>
<tr>
<td>i 4</td>
<td>1.356</td>
<td>6.457</td>
</tr>
<tr>
<td>m 5</td>
<td>1.250</td>
<td>5.954</td>
</tr>
<tr>
<td>e 6</td>
<td>.818</td>
<td>3.895</td>
</tr>
<tr>
<td>n 7</td>
<td>.767</td>
<td>3.653</td>
</tr>
<tr>
<td>s 8</td>
<td>.710</td>
<td>3.380</td>
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<tr>
<td>i 9</td>
<td>.654</td>
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<td>o 10</td>
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</tr>
<tr>
<td>0 12</td>
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### Table H.2: Total variance explained

<table>
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<tr>
<th>Eigenvalue #</th>
<th>Random Eigenvalue</th>
<th>Standard Dev</th>
</tr>
</thead>
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<td>.0306</td>
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<td>1.1187</td>
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<td>.0239</td>
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<td>0.9196</td>
<td>.0276</td>
</tr>
<tr>
<td>13</td>
<td>0.8733</td>
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<tr>
<td>14</td>
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<td>.0234</td>
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<td>21</td>
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</tr>
</tbody>
</table>

### Table H.3: Parallel analysis results from ‘Monte Carlo PCA for Parallel Analysis’

**Notes:** Number of variables: 21; Number of subjects: 187; Number of replications: 100

<table>
<thead>
<tr>
<th>Component number</th>
<th>Actual eigenvalue from PCA</th>
<th>Criterion value from parallel analyses</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.130</td>
<td>1.659</td>
<td>Accept</td>
</tr>
<tr>
<td>2</td>
<td>2.048</td>
<td>1.532</td>
<td>Accept</td>
</tr>
<tr>
<td>3</td>
<td>1.729</td>
<td>1.448</td>
<td>Accept</td>
</tr>
<tr>
<td>4</td>
<td>1.356</td>
<td>1.341</td>
<td>Accept</td>
</tr>
<tr>
<td>5</td>
<td>1.250</td>
<td>1.244</td>
<td>Accept</td>
</tr>
</tbody>
</table>

### Table H.4: Comparison of eigenvalues from principal component analysis (PCA) and the corresponding criterion values obtained from parallel analysis
Appendix I: User Acceptance of Second Life in Higher Education - Questionnaire

The questionnaire contains three sections and approximately takes about 15 minutes to complete.

SECTION I:

This section contains questions about your demographics, experience and usage of Internet and Second Life (SL).

1. What is your gender? ☐ Male ☐ Female

2. What is your age? ___________ (in years).

3. What is the highest level of education that you have completed?
   ☐ High School ☐ TAFE ☐ Undergraduate ☐ Postgraduate ☐ Others: _______

4. How long have you been using Internet?
   ☐ less than 2 years ☐ 2-4 years ☐ 5-6 years ☐ 7-8 years ☐ 9 years and more

5. How many times do you use Internet during a week?
   ☐ not at all ☐ less than once a week ☐ about once a week ☐ 2-3 times a week ☐ several times a week ☐ about once a day ☐ several times each day

6. What is your primary place of Internet use?
   ☐ Campus ☐ Home ☐ Work ☐ Internet cafe ☐ Others: ____________

7. How long have you been using SL?
   ☐ less than 3 months ☐ 3-6 months ☐ 7-12 months ☐ 1-2 years ☐ 2 years and more
Appendix I

8. What is your primary place of SL use?
☐ Campus ☐ Home ☐ Work ☐ Internet cafe ☐ Others: _____________

9. What is your primary purpose of using online 3D virtual worlds?
☐ Study ☐ Work ☐ Entertainment /fun ☐ Personal ☐ Social ☐ Others: ______

SECTION II:

This section contains questions about your perceptions on the *Ease of Use, Usefulness, Social Norms and Behavioural Intention* to use Second Life. Please rate your answers on a scale of 1 (Strongly Disagree) to 7 (Strongly Agree).

**Perceived Ease of Use (PEU)**

PEOU1: Learning to use Second Life is easy for me.
PEOU2: I find it easy to get Second Life to do what I want it to do.
PEOU3: I find Second Life to be flexible to interact with.
PEOU4: It is easy for me to become skilful at using Second Life.

**Perceived Usefulness (PU)**

PU1: Using Second Life enables me to accomplish my tasks more quickly.
PU2: Using Second Life improves my class or work performance.
PU3: Using Second Life increases my productivity.
PU4: Using Second Life makes it easier for me to understand lecture.
PU5: Using Second Life makes it easier for me to communicate with lecturer/friends.
PU6: Overall, I find Second Life useful in my study/work

**Social Norms (SN)**

SN1: People who influence my behaviour think that I should use Second Life.
SN2: People who are important to me would think that I should use Second Life.
SN3: People whose opinion I value would prefer me to use Second Life rather than other 3D virtual environments (such as Active Worlds or there.com).
SN4: I think that those people who are important to me would want me to use Second Life rather than other 3D virtual environments (such as Active Worlds or Club Penguin).

**Behavioural Intention (BI)**

BI1: Assuming I had access to Second Life, I intend to use it.
BI2: Given that I had access to Second Life, I predict that I would use it.
BI3: I will use Second Life frequently in the future.
SECTION III:

This section contains questions about your perceptions on the Emotional and Imaginational responses towards usage of Second Life. Please rate your answers on a scale of 1 (Strongly Disagree) through 7 (Strongly Agree).

Perceived Emotional Responses (PER)

Enjoyment (EN)

EN1: I have fun using Second Life.
EN2: Using Second Life provides me with a lot of enjoyment.
EN3: I enjoy using Second Life.

Emotional Involvement (EI)

EI1: When I am using Second Life, I feel "carried off" by the 3D virtual environment.
EI2: When I am using Second Life, I feel as if I am part of the 3D virtual environment.
EI3: When I am using Second Life, I feel deeply about the 3D virtual environment.

Arousal (AR)

AR1: Using Second Life makes me stimulated.
AR2: Using Second Life makes me excited.
AR3: Using Second Life makes me inspired.

Perceived Imaginative Responses (PIR)

Fantasy (FA)

FA1: Using Second Life helps me construct fantasies.
FA2: Using Second Life helps me create daydreams.
FA3: Using Second Life helps me augment reality.

Escapism (ES)

ES1: Using Second Life helps me escape from the world of reality.
ES2: Using Second Life helps me escape from problems and pressures.
ES3: Using Second Life helps me escape from things unpleasant and worrisome.

Role Projection (RP)

RP1: Using Second Life enables me to project myself into a particular role.
RP2: Using Second Life enables me to project myself into a particular character.
RP3: Using Second Life enables me to project myself into a particular task.
Appendix J: Un-rotated PCA results for User Acceptance of Second Life

Table J.1 shows the significant values for KMO (.793) and Bartlett’s test (.000).

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</th>
<th>.793</th>
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</thead>
<tbody>
<tr>
<td>Bartlett's Test of Sphericity</td>
<td></td>
</tr>
<tr>
<td>Approx. Chi-Square</td>
<td>2655.016</td>
</tr>
<tr>
<td>Df</td>
<td>595</td>
</tr>
<tr>
<td>Sig.</td>
<td>.000</td>
</tr>
</tbody>
</table>

Table J.1: KMO and Bartlett's Test

Table J.2 results in eight factors with eigenvalues above 1. However, the comparison of actual eigenvalues (from Table J.2) and criterion values (from Table J.3) allows us to retain only six factors, which are listed in Table J.4 and matches the same number of factors used in our study.

<table>
<thead>
<tr>
<th>Component</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>9.522</td>
<td>27.206</td>
</tr>
<tr>
<td>3</td>
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<td>5.029</td>
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<tr>
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<td>1.170</td>
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### Table J.2: Total variance explained

<table>
<thead>
<tr>
<th>Eigenvalue #</th>
<th>Random Eigenvalue</th>
<th>Standard Dev</th>
</tr>
</thead>
<tbody>
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<td>Component number</td>
<td>Actual eigenvalue from PCA</td>
<td>Criterion value from parallel analyses</td>
</tr>
<tr>
<td>------------------</td>
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<tr>
<td>1</td>
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</table>

**Table J.3: PCA results from ‘Monte Carlo PCA for Parallel Analysis’**

*Notes: Number of variables: 35; Number of subjects: 122; Number of replications: 100*

**Table J.4: Comparison of eigenvalues from principal component analysis (PCA) and the corresponding criterion values obtained from parallel analysis**